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A SHORT SURVEY OF THE SOLIFUGAE
OF SOUTH AFRICA

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With 8 plates and 14 text figures

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A SHORT SURVEY OF THE SOLIFUGAE OF SOUTH AFRICA

INTRODUCTION.

THE study of the Solifugae has absorbed a certain amount of attention from Zoologists for many years. Morphologists regard them with interest because of the retention of primitive characters in their structure, as is conspicuously exhibited in the segmentation of the body: the systematist, on the other hand, is equally impressed by the remarkable diversity of forms found within the same genus, the variations of which seem to be promiscuous and largely discontinuous.

The Solifuge fauna of S. Africa is particularly rich: indeed, a fauna so abounding in genera and species as that found in the western and central portions of this subcontinent is not known from any other part of the world.

For our knowledge of the species we are indebted to various workers, but more particularly to Mr R. I. Pocock, Prof. K. Kraepelin and Dr W. F. Purcell. Mr Pocock's pioneer papers on the material in the British Museum of Natural History constitute the first important attempt to make known the great diversity that obtains within the limits of this order, and to classify the genera and species. His work considerably advanced the knowledge of this subject, but was somewhat marred by the very inferior illustrations that accompanied his accounts.

A few years later, Prof. Kraepelin's very useful monograph of the whole order was published in *Das Tierreich*. In this work all the known species were described, and the important characters as far as possible illustrated. Thus, it was, and still is, quite indispensable to students of this order, but is no longer sufficient as a guide to the species of the less familiar genera such as *Blossia*.

The best contributions to our knowledge of S. African Solifugae are those contained in Dr Purcell's several papers, based on the collections of the S. African Museum. These are sufficiently accurate and detailed to be accepted as a very reliable starting point in the study of our fauna.

Since the appearance of the above mentioned works, various new species have been described by the late Prof. Kraepelin and by the present writer. Kraepelin's papers are useful as presenting his final accounts of the fauna of South-West Africa and of the Kalahari.

During recent years a great deal of additional material has accumulated in the collections of the Museums of S. Africa, and although adequate material for even a moderately complete account of the variation exhibited within this order in S. Africa is still unavailable, yet I think a sufficient amount of new data has been obtained to justify the following revision of all the known species and varieties. The imperfections of our knowledge will be understood from the fact that very many species are only known from single specimens.

The present paper, based mainly on the collections of the Albany and

Transvaal Museums, is presented as a guide to the characters and gross distribution of the various genera and species now known to inhabit South Africa, the northern limits of which are the Zambesi and Cunene rivers on the east and west sides respectively: all the distribution data of earlier authors have been incorporated, but for detailed descriptions of the various species reference must be made to the original accounts.

SOME GENERAL REMARKS ON THE EXTERNAL STRUCTURE OF SOLIFUGAE.

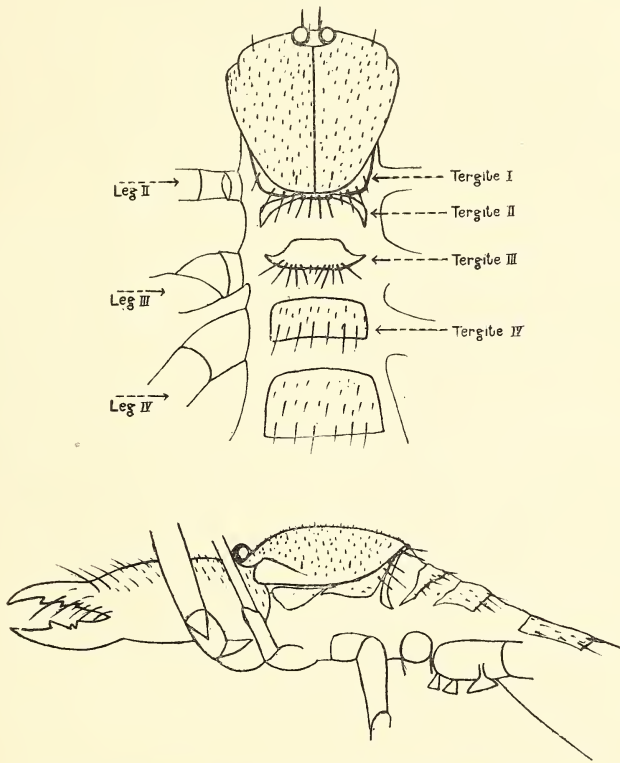
Some of the external characters presented by the Solifugae are very stable: the segmentation of the body and of its appendages (excluding the tarsi of the legs), and the position of the various apertures of the body, are thus not available for systematic purposes. The most important characters employed in the classification of the S. African forms are: The segmentation of the tarsi of the legs, the structure of the male flagellum, the nature of the dentition, and the modification of the hairs and bristles which clothe the various surfaces. Most workers have also attached considerable importance to the features of the very characteristic rostrum or camerostome¹ which has the mouth at its apex, but such variations as do occur in this structure amongst the various genera are not very striking, and seem to me of doubtful value in a natural classification.

The segmentation of the body is described in a general way in most text books of invertebrate zoology, and can be easily determined from fresh specimens or spirit-preserved material. Some confusion may arise in the case of *Hexisopus* and *Chelypus* where the tergites of the abdomen are not strongly chitinised, and thus are not easily distinguished. A source of difficulty may also be found in the segmentation of the thorax, the dorsal sclerites of which are much reduced in all Solifugae. In the accompanying figures, the relationship of these sclerites to the appendages has been indicated in accordance with the views expressed by Mr H. M. Bernard in his important treatise on the morphology of this order (27).

It should be mentioned, however, that the celebrated arachnologist W. Sorensen has recently presented a different interpretation of the sclerites behind the head-plate (28). He recognises only two thoracic tergites, viz. those labelled as third and fourth in this paper: according to him, those here labelled as first and second cannot be true tergites, because the elevator muscles of the appendages are not inserted thereon. Sorensen thus interprets the structure of a solifuge: head bearing four

¹ This has been homologised by Croneberg and by Gaskell (see *The Origin of Vertebrates*, pp. 222, 223) with the first antennae of Crustaceans: for another view see Bernard's monograph. The terms applied in this paper to the various appendages are those in current use amongst Arachnologists, and have no reference to their respective homologies with the appendages of other Arthropods. I may remark that the very characteristic chelicerae—sometimes unfortunately termed the mandibles—are apparently homologous with the second antennae of Crustaceans and with the antennae of insects, whilst the pedipalpi or palps are homologous with the mandibles of other Arthropods.

pairs of appendages, thorax with two tergites and two pairs of appendages, abdomen of 11 segments, the first of which is greatly reduced whilst the second or genital segment is largest. With regard to the thoracic tergites, I prefer Bernard's view seeing that the bristly armament of all four sclerites (the second excepted) in *Blossia* has much in common but differs from that of the head-plate: in short, they seem to be homologous structures. The two separated portions of the second tergite are certainly devoid of spines or bristles in *Blossia*, but a few setae occur near the anterior edge in *Hemiblossia*. It may be added



Text fig. 1. Dorsal and lateral views of the cephalothoracic region of a female *Blossia* sp.

that the third tergite, though not divided, has its spines in two separated groups.

For an ingenious hypothetical explanation of the composition of the head-plate, the reader is also referred to Mr Bernard's paper. Here, I only mention this structure in order to direct attention to variations therein. Amongst the various S. African genera there are considerable differences in the shape of the head-plate, the proportions of which moreover may differ greatly in the two sexes of the same species, the female being more robust than the male. In most genera, the lateral portion,

extending ventralwards on each side, is not very extensive, but in Chelypus and Hexisopus the lateral extensions are quite strongly developed, and the head-region is thus particularly robust. Normally, the lower portion of this lateral extension is separated from the upper only by a deep broad groove, but in Blossia the compound nature of the structure is indicated by a well-marked suture line, running immediately ventral to the somewhat ill-defined groove and separating off the lowest portion of the lateral extension as a distinct sclerite: the suture line is faintly indicated also in other genera. This sclerite may possibly be an isolated anterior portion of the first tergite, but in Blossia is not completely fused with the forward continuation of what appears to be the first thoracic tergite. It may also be noticed that whereas in most Solifugae the anterior lateral lobe of the head-plate, which is said to bear rudimentary eyes¹, is only partially separated from the main plate, a more complete separation occurs in Chelypus, where a fairly distinct suture line extends backwards to the posterior margin of the plate.

The segmentation of the legs, excluding the tarsi, is fundamentally similar throughout the order. Dr Purcell in describing Hexisopus (9) laid some stress on the supposed fact that this genus has a reduced number of trochanter segments, thus differing from all other known genera. The same view seems to have been held previously by Mr Simon, for, in his account of *Hexisopus fodiens*, the trochanter segments are given as two, and the tarsal segments also as two. In *Das Tierreich*, Purcell's views on the homology of these leg segments are mentioned, but Kraepelin adopts what is undoubtedly a more correct interpretation, without however presenting any reasons for his homologies. In most Solpugids, the distal trochanter segment of legs II-IV is very characteristic, having a dorsal infolding of chitin marked externally by a definite line extending over the length of the segment. In Hexisopus, this line is scarcely noticeable, and as the third trochanter of leg IV is greatly elongated, like a femur, whilst the true femur is abbreviated, a confusion of homology is not surprising. The third trochanter of leg IV in Chelypus, however, shews the dorsal line very distinctly and there can be no doubt of the identity of the segment. The homologies of the leg segments can also be traced quite independently from the character of the articulations, certain of which are quite distinctive. In a Solpuga, there are specialised areas of thickened chitin arranged in pairs at particular joints, where the movements of the segments concerned are restricted to one plane, viz. between the patella and tibia of the palp, between the femur and patella, and between the patella and tibia of all the legs. In the second or third leg of Chelypus these can be seen without difficulty, and, relying on this character alone, the third leg of Chelypus is found to have three fairly large trochanter segments but only one tarsal segment.

In the terminology of the segments of the legs, I prefer to follow

¹ W. Sorensen was unable to find the rudimentary eyes, nor could the present writer. In the recent edition of the *Encyclopaedia Britannica*, E. R. Lankester speaks of "a pair of median eyes and obsolete lateral eyes on each side."

Pocock's scheme¹, as given in the Arachnida volume of the *Fauna of British India*, rather than that adopted by Kraepelin or the slightly different one of Sorensen: it may be noted, however, that Pocock's account is not free from error, for he represents legs II-IV as having each the same number of trochanter segments. The segments of the palp are: coxa, trochanter, femur, patella, tibia, and tarsus, which latter is usually fixed immovably to the tibia, is without claws, and is composed of one segment, excluding the rudimentary segment or segments found in the terminal sucker, which according to Sorensen is morphologically equivalent to the claw-bearing plantula of a walking leg. The segments of the legs are similar, but between the coxa and the femur there are several trochanter segments, viz. two in legs I and II, and three in legs III and IV: a special term is given to the distal trochanter segment in each case, viz. the trochantin, although it is represented both by Kraepelin and Sorensen as "the basal joint of the femur," and thus equivalent to the single segment called trochanter in the palp. The middle trochanter segment of legs III and IV is termed the trochantella. This and the proximal segment to which the term trochanter now becomes restricted are, according to Sorensen, parts of the coxa—a conclusion which seems to me very reasonable from consideration of such a case as the fourth leg of *Chelypus*. The joints between trochantella and trochantin, and between trochantin and femur, permit of a good deal of twisting of the leg, but, as previously mentioned, the next two joints only permit of movements in one plane. The tarsi of the legs present a character which varies considerably throughout the order, although within the limits of the same genus the tarsal characters are generally very constant in specimens of all ages. The segmentation of the tarsi is utilised as a very convenient generic character, the range of which is sufficiently indicated in my key to the genera.

In various genera, the tarsus of the fourth leg is more numerously segmented than the tarsi of preceding legs, and as this multi-segmented condition is presumably secondary, the occurrence of minor segmented aberrations from the normal may perhaps be expected. I believe that such aberrations will prove to be not very uncommon. One such has even been made the type of a distinct genus (*Broomiella* Pock.), for this seems to be founded on an abnormal specimen of *Daesia schreineri*, having a two-jointed fourth tarsus instead of the usual four-jointed tarsus. I have also seen a male of *Solpuga hostilis* from Doornkop, in

¹ Nevertheless, within the comparatively narrow limits of the Arachnida, the homologies of the individual segments of the legs amongst the various orders are by no means certain: whilst a uniform nomenclature for the Arthropoda as a whole seems quite impracticable on the basis of homology. Many morphologists believe that a though the palp in many orders is 6-jointed, yet the segmentation is not strictly homologous throughout: as Pocock on the other hand has represented it. This view is set forth in Simon's important work *Histoire naturelle des Araignées*. Thus, a patella of the type found in spiders is held to be wanting in the Solifugae, and it must be admitted that the nature of the articulations is quite different in these two orders: the segment termed patella in this paper is represented to be equivalent to the combined patella and tibia of spiders, and the segment here called tibia as homologous with the metatarsus of spiders.

which the third leg on the right side has a seven-jointed tarsus, like the fourth leg, whilst that on the left side is four-jointed as usual: the right third leg is apparently not abnormal in any other way, the basal portions being like those of a normal third leg.

The spinulation of the legs is also a very constant character within the same genus. Spines are most strongly developed in the genus *Solpuga*, where legs III and IV are spined as follows: *Fourth leg*, patella with a pair inferiorly near the apex, tibia with five (sometimes six or four) on the anterior surface, and three (but varying from two to five) on the posterior surface, tarsus with ten pairs inferiorly (or 11-10): *Third leg*, patella with two at the apex superiorly and three on the inferior surface, including a pair at the apex, tibia with five superiorly and three pairs inferiorly (occasionally 4·3 or 4·4), tarsus with seven pairs inferiorly. The first leg is completely devoid of spines, and the second leg is spined more or less like the third but the tibia may have 3·2 or 2·1 spines ventrally and the tarsus four spines or none externally above. These are all strong spines: in addition, there may be shorter and weaker ones on the second and third tarsi inferiorly.

In all other genera the number of spines on the tarsi are fewer: in *Daesia*, the tarsus of leg IV has three pairs of spines infero-laterally.

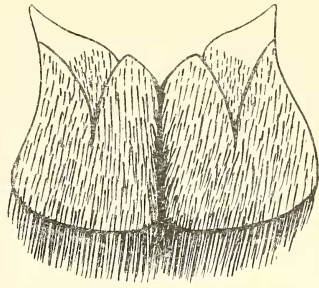
EXTERNAL SEXUAL DIFFERENCES.

Externally, the sexes are distinguished primarily on the characters of the first abdominal sternite (it is actually the second sternite according to Sorensen). This genital sternite is seen in its simplest form in the adult female of the genus *Lipophaga*, where the two flaps, representing a pair of appendages, remain quite distinct from each other and either one can be raised independently: the posterior mesial angle of each flap is acute. In other genera, these flaps are firmly united along the midline by membrane: sometimes, as in *Solpuga venator*, union takes place along the whole length of the flaps, and their hind borders are broadly rounded on each side: occasionally, as in *Solpuga chelicornis* and *hostilis*, an acute posterior lobe at the apex of each flap remains free, a condition which presumably is more primitive than that of *venator*. The female genital aperture lies in the soft skin posterior to and protected by the sternite, and is quite large in adults. In adult females of *Solpuga* there is often a small brown scar or several scars on the anterior portion of the genital sternite mesially: this is presumably a mark made by the male during the mating process and is thus indicative of sexual maturity¹.

On the other hand, the genital aperture of the adult male opens on the surface of the same sternite. The two halves are united together, but in the middle they enclose a pair of long convexly raised sclerites between which mesially is the elongated slit-like genital aperture. These sclerites occur in young males as well as in adults but are much larger in the adults relatively as well as absolutely.

¹ An account of the mating habits of *Galeodes* is given by R. Heymons in a paper entitled "Biologische Beobachtungen an asiatischen Solifugen" in *Abh. Preuss. Akad. Wiss. Berlin*, 1901.

Each half of the genital sternite is actually a compound structure in both sexes: the parts of which it is composed are entirely fused together posteriorly, but anteriorly the suture lines can be easily recognised. The half sternite is therefore interpreted by Bernard as derived from two segments of an appendage incompletely separated by interarticular membrane, and I may remark that the so-called segmental and interarticular regions are somewhat different in their coverings of hair: in the example figured (*Daesia lineata*) the triangular interarticular portion is clothed only with comparatively short fine hairs whilst the rest of the sternite bears also a great number of much longer and stiffer setae which are cleft or even trifurcated at the tips.



Text fig. 1 a. Genital sternite in the adult female of *Daesia lineata*: flattened out. That of the male is similar, but has also a pair of elongated sclerites mesially.

In most species, the adult male is characterised by the possession of the flagellum on each chelicera. This organ is derived from a socketed bristle, and thus the rotatable flagellum of a *Blossia* presumably represents a more primitive condition than that of *Solpuga* which is fixed. Dr Purcell has described an enlarged feather bristle in the genus *Melanoblossia* as a flagellum, and in other genera could find no flagellum whatever in what appeared to be the adult male. It now appears that more or less enlarged feather bristles may co-exist with a true flagellum in the genus *Blossia*: this occurs in the species *B. falcicornis* and *B. filicornis*, where some of the more distal feathered bristles of the series on the mesial surface of the chelicera are considerably longer and stronger than those proximally situated. Moreover, the position of the point of attachment of the flagellum relative to the series of feather bristles is very variable: sometimes in the genus *Blossia* it is at the distal end of the line of feather bristles, but in *Blossia falcifera* it lies between the distal enlarged bristles and the dental series, whilst in the genus *Daesia* the base of the flagellum is far removed from the line of feather bristles. However, Sorensen, after examining in some detail the structure and homology of the flagella of several genera, concludes that morphologically the flagellum is the superior bristle or the two superior bristles of the series.

I am satisfied that Sorensen's conclusion is quite correct. Not only is the original relation to the line of feather bristles retained in the genus *Blossia*, but here too the flagellum is primitive in form, being a greatly inflated bristle cut open along its length. The genus *Solpuga*, which is far more specialised, affords confirmatory evidence, although the flagellum of adults has little resemblance to a bristle. The mesial surface of the upper jaw of a very young *Solpuga* presents two long oblique series of bristles, that adjacent to the cutting edge including about 23 bristles, all feathered with the exception of the distal one which is fairly long but simple: the other series, parallel thereto, consists entirely of simple

bristles, the basal ones stout and strong and the distal ones much more slender. In older specimens, the feather bristles are more numerous and may occupy several rows. On examining a subadult male of *S. derbiana*, as yet without a flagellum proper, I find near the distal end of the feathered series several simple bristles of which one is markedly stouter than the rest and strongly curved like the feather bristles. This enlarged bristle, which seems to correspond with the single one at the distal end of the feathered series of juvenile specimens, is presumably destined to become the flagellum at the last moult.

In such genera as *Blossia* and *Hemiblossia* the feather bristles of the adult, in both sexes, occupy only a single series of about 14-17: they are all feathered, the distal ones often larger than, but not so strongly feathered as, the basal bristles. *Daesia* has more numerous bristles arranged in a double row in the adult, all being feathered.

The primitive flagellum of the *Daesiinae* is simply a membrane with more or less infolded edges which basally unite to form a cup: the rotatable flagellum of *Hexisopus* and of *Ceroma* is probably to be derived therefrom by more extensive fusion throughout its length, whereby the free membrane becomes converted into a flattened tubular shaft: the fixed flagellum of *Solpuga* has a swollen basal enlargement which probably corresponds to the cup-like base found in *Blossia*, and the more or less elongated shaft is usually if not always perforated by a fine canal along its length. The flagellum of *Solpuga* is far more variable in form than the primitive flagella of the *Daesiinae* and *Hexisopodinae*: in the least modified species such as *suffusca*, it lies on the flat or convex upper surface of the chelicera, but in various specialised forms of the *hostilis* group the basal portions of the flagellum become sunk into a distinct depression of the inner and upper surfaces of the jaw.

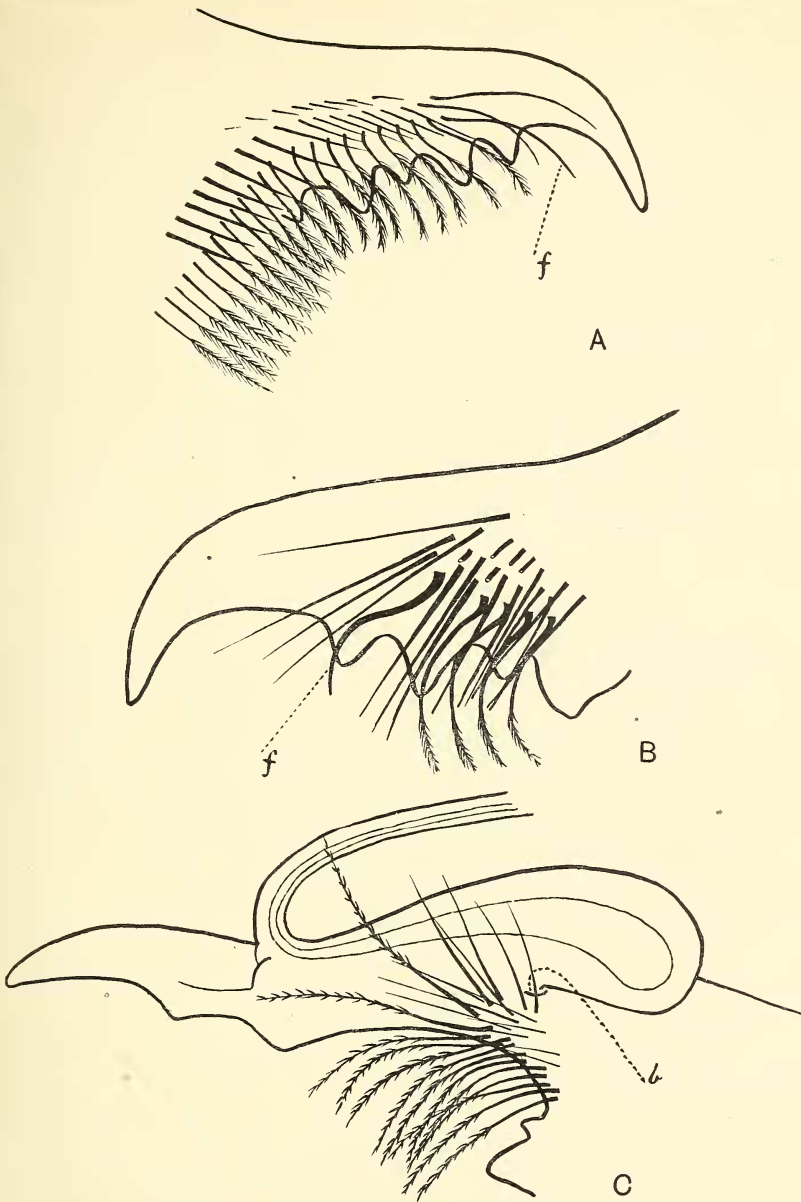
In the *Daesiinae* the adult males are often provided with curiously modified bristles on the second abdominal sternite: these are absent in females or if present are not so highly developed as in males.

When bristles and spines occur over the surfaces of the appendages and body they are more strongly developed in males than in females, except on the mesial surfaces of the jaws.

Other secondary sexual characters are presented by the dentition, which is often greatly modified in the adult male but primitive in the female: the malleoli of males are much larger than those of the females: lastly, males are more slender than females, having longer limbs and smaller bodies but the disparity in size is not great.

The adult male of *Solpuga* has an organ on the palp, viz. the Scopula, which is quite absent in females. It is composed of numerous, closely packed, short, feathered hairs, which are presumably sensory in function. It is interesting to notice that a similar organ occurs on the tarsi of the legs in the adult male of *Stasimopus* (trap-door spider), but not in the female. I have elsewhere¹ presented reasons for regarding the Scopula of *Stasimopus* as an organ of smell. There is an important difference,

¹ "Note on the occurrence of a pedal nose in the male of a trap-door spider (*Stasimopus*)" in *South African Journal of Science*, March, 1917.



Text fig. 1 b.

- A. Mesial surface of upper jaw of young *Solpuga* from Pretoria (? *globoicornis*), having only 3 malleoli: shewing parallel rows of feather bristles and of simple bristles.
- B. Distal portion of upper jaw of subadult male of *Solpuga derbiana* (basal portions only of some of the simple bristles are indicated).
- C. Distal portion of upper jaw of adult male of *Solpuga derbiana*.

[f = flagellar bristle. b = point of origin of flagellum.]

however, in the hairs of the two Scopulae: those of *Stasimopus* are simple, but truncated or more or less trumpet-shaped at the tips where the protoplasmic core comes into close contact with the exterior: those of *Solpuga* are well feathered, and the tips finely pointed. If the receptive portion of an olfactory organ must necessarily permit of direct contact between living protoplasm and odoriferous particles, it does not seem probable that the scopula of *Solpuga* can subserve an olfactory function. Perhaps the truncated bristles such as occur commonly on the palps almost throughout the Solifugae will prove to be olfactory. Although I have not specially searched for sensory organs I may add that organs, apparently of sensory function, have been found by H. J. Hansen¹ and by H. M. Bernard and were identified as Lyriform organs. In the Solifugae they are almost confined to the chelicerae. In addition, there are what seem to be sensory organs near to the cutting edges of the jaws: over the surface of the fang and on the outer side of the jaw near to the row of teeth the thick chitin is pierced by numerous very long canals, each opening by a small pore on the surface. Similar organs occur in great numbers on the legs of various spiders, along with the several more complicated structures to which the term "lyriform" was originally applied.

NOTES ON SPECIFIC CHARACTERS.

The characters employed in the discrimination of species are primarily those peculiar to the adult male. Although various authors have also attempted to distinguish species on female characters, and have drawn up keys to the species of *Solpuga* based mainly on such characters as are afforded by measurements and colour, yet with the larger amount of material now available it seems to me quite impossible in many cases to distinguish between the females of closely allied species. They are often much more generalised than the males. This is markedly the case in respect to the dentition, which is highly variable amongst the males of different species and genera, but is essentially identical throughout the females of many species of *Solpuga* and even of widely different genera such as *Zeriassa*, *Blossia* and *Daesia*. This type of dentition, found both in males and females of *Solpuga venator* or of *S. lethalis*, is without doubt primitive.

On the dental characters, the females of the genus *Solpuga* can be divided into several groups, the largest including all those species exhibiting the primitive type of dentition; one small aberrant group includes *S. lineata* and allies, which have a much modified dentition in the upper jaw of both sexes, and might with some propriety be assigned the rank of a distinct genus: the two species *picta* and *schultzei*, only known from female specimens, constitute a third group; another little group is that of *S. hastata* and allies, and lastly the species *S. fusca* differs from all others in the genus in the character of two or three intermediate teeth, instead of one only, in the lower jaw. On the other characters found in females, it is possible to divide the genus a little

¹ "Organs and characters in different Orders of Arachnids." *Ent. Med. u. a. Ent. For. Fr. Meinert*, 1893, p. 178, Kjobenhavn.

further. These characters are: the colouration, which does not vary much within a species, being similar in the two sexes, and fairly constant throughout large groups of species: the shape of the hind borders of the genital sternite, whether broadly rounded on each side or produced into a pair of mesial lobes, the former condition being correlated on the whole with plain colouration, and the latter condition with strongly contrasting colours such as occur in the *hostilis* group: also, but of somewhat less value is the degree of hairiness of the hind legs, long silky hairs being most strikingly developed in *S. sericea*, whilst such hairs are absent in *venator* and allies but more or less strongly developed in the species of the *hostilis* group: finally, the proportions in length of the segments of the palps, and legs, compared together and with the breadth of the head-plate, and the degree of development of cylinder bristles on the lower surfaces of the palp are characters which may serve to distinguish the females of certain species from each other. But, having thus relegated a specimen to its natural group, it is usually impossible to proceed further. Dr Purcell has commented on the difficulty of distinguishing between the adult females of *S. venator* and *S. lethalis*, and I may add that the three species *ferox*, *schönlandi* and *globoicornis*, though very markedly distinct in the male sex, are practically identical in females. In this paper I have therefore largely ignored the females when distinguishing between species, and those species which have been founded only on female specimens by previous authors are now placed aside as *incertae sedis*: most of them can never be identified, except through the locality data.

The systematics of the genus *Solpuga* is largely a study of variation in the male flagellum. This organ presents quite a bewildering series of forms throughout the genus, but usually shews a high degree of constancy in the same species. Many of its forms shew no obvious relationship to each other: indeed, to a large extent the variation appears to be quite erratic and discontinuous. Species which in structure are practically identical as females, and which are no doubt closely related, may nevertheless have profoundly different flagella, as is the case in *ferox*, *schönlandi* and *globoicornis*, the flagella of which so far as is known are not connected together, even indirectly through other species. It is obvious therefore that as a guide to genetic affinity the characters of this organ may be of very subordinate value. Discontinuous variation is noticeable in every section of the genus, but is accompanied by considerable variation of a continuous type. Dr Purcell has remarked on the variation in length exhibited by the flagellum of *S. venator* in specimens from various localities (9). In this case, a fairly wide range is observed, and it might be possible to distinguish several races or local forms on differences in the length of the shaft, the northern varieties having a longer flagellum than southern forms. In such a continuous series, the elimination of the intermediate forms would result in the formation of quite distinct groups. However, I do not know of any pair of species which differ from each other only in the length of the flagellum, and as a matter of fact, the observed variation in length of the flagellum in most species is limited to a comparatively narrow range. Nevertheless, in some sections of the

genus, the characters which distinguish the several forms commonly termed species are not of an essentially discontinuous type. There is a small group of species, characterised by the more or less strongly twisted shaft of the flagellum, and the presence of serrated edges along some portion of this shaft. These species (*spiralicornis*, *serraticornis* and *strepsiceros*) seem to represent separate links in a chain of continuously varying forms: a complete series of intermediate forms is not yet known, but sufficient variation has been noted in a small series of *spiralicornis*, and in several specimens of *serraticornis*, to indicate that the specific distinctions, though greater in magnitude, are essentially of the same kind as those which are now included within the limits of the same species, and which are clearly of the continuous type. I suspect it will eventually be found that the species *cervina*, *collinita* and *alcicornis* are also forms of one continuous series: and apparently another such series is that of *lethalis typicus*, *lethalis rectus* and *furcifera*.

Amongst the nocturnal species, which constitute the most primitive group of the genus, it sometimes happens that the only noticeable differences between species are those of the flagellum. This is the case with *S. lethalis* and *S. venator*, for the minor difference of dentition which is also said to distinguish them is not constant, and moreover is commonly found within the limits of a single species.

In these nocturnal species, the dentition of the male greatly resembles that of the female, and several other characters of the chelicerae, viz. the strong development of stridulatory ridges, and the abundance of well-feathered bristles in both upper and lower jaws are common to both sexes.

More usually, profound differences of dentition, or of spinulation, accompany the variations of the flagellum. Sometimes indeed, the characters of the flagellum may remain very constant throughout a group of forms which differ amongst themselves in the dental characters. This is the case, at least so far as the shaft of the flagellum is concerned, throughout the species *hostilis*, *derbiana*, and *tookei*, the most characteristic feature of the shaft being its sharp blade-like termination: this same blade with modifications also occurs in *hamata* and *bechuanica*: it seems to be quite constant in *hostilis*, but is variable in *derbiana*, and therefore cannot be regarded as an absolute unit character in a strict sense.

The variations of dentition in the *hostilis* group of species are indeed very numerous. The dentition is comparatively constant within the limits of any one form, and such forms as *hostilis* may have a fairly wide geographical range: but, we are still uncertain whether the various types are fundamentally distinct, or are units of one or several continuous series. The occurrence of a dentition so aberrant as that of *junodi* in the midst of an area occupied by allies (*hostilis*, *marshalli*) which share the most characteristic feature of quite a different dental type, is suggestive of mutational variation. On the other hand, the additional material received during recent years has to some extent served to bridge the wide gaps which formerly seemed to separate types so distinct as *chelicornis*, *hostilis* and *junodi*. The typical form of *chelicornis*, found in the karroid portions of the Cape, is represented at Kakamas by a dis-

tinct variety, *macrognathus*, with elongated jaws, which, in the dentition, is not very different from *hamata* found in the Waterberg district; and again, either of the two latter forms can by slight modification be changed into *bechuanica*, as found at Serowe in the Bechuanaland protectorate; this by reduction of the two anterior teeth leads on to *hostilis* of the Transvaal and *marshalli* of Mashonaland, or by enlargement of the same teeth to *junodi* of the Zoutpansberg and Waterberg districts. The known facts seem to be easily interpreted as the results of continuous variation, but it is proper to add that a complete series of intermediates is unknown, and that, from the nature of the case, all possible variants of the dentition could be arranged within an apparently continuous series arbitrarily chosen.

Other characters of systematic value, found amongst males, are the spines or bristles on the upper and outer surfaces of the chelicerae, and the tooth or keel which is often present on the dorsal edge of the mesial surface of the upper fang. These characters in particular species are often highly developed, and present the appearance of hypertrophied structures. The dorsal tooth of the fang of *ferox*, for example, is very markedly stronger than that of any other species.

This hypertrophied appearance, which is also exhibited by the characters of the flagellum (cp. that of the *cervina* group) and of the dentition (cp. *marshalli*) in various species, seems to suggest that variation, either continuous or discontinuous, has proceeded uncontrolled beyond the limits actually required by the creature for the maintenance of its race. That is to say, it seems improbable that natural selection can have been the sole guiding factor in directing the course of variation. Unfortunately, this view cannot be checked by an adequate body of facts based on acquaintance with the mode of life of the various species. The function of the flagellum itself is unknown: it is not a weapon of offence or defence, and according to Heymons' account of the breeding habits in *Galeodes*, is not employed during the mating process. Nevertheless, Sorensen believes that the flagellum is eminently adapted to the function of handling spermatophores and states emphatically: "Le flagellum est l'organe copulateur des Solifuges." At present, this is unsupported by observations on the living animal, and to me the hypothesis seems improbable in view of the extraordinary diversity in form presented by the shaft and the complete absence of the flagellum in some genera¹.

¹ See also R. I. Pocock in *A Monograph of the Terrestrial Carboniferous Arachnida of Great Britain*, 1911, p. 2: "An important factor in the evolution of terrestrial Arachnida has been, in my opinion, a change from the method of pairing, as practised by Scorpions, to new and special methods, resulting in the modification of a part of one of the prothoracic limbs into an intromittent organ, often of great complexity. This may be seen in the Araneae, where the palps are modified, in the Solifugae, where the mandibles are modified, in some of the Acari, and lastly in the Ricinulei, where the legs of the third pair are modified. Even the Opiliones possess very special secondary reproductive organs."

In the Cambridge edition of the *Encyclopaedia Britannica* the account of Arachnida by E. Ray Lankester includes the following: "? intromittent organ of male (solifuge) lodged on the dorsal side of the first pair of prosomatic appendages."

In the *hostilis* group of species, which are all diurnal in habit, it is noteworthy that the stridulatory ridges on the chelicerae are usually reduced or even quite absent in the males, but are well developed in the females. Whilst losing the power to stridulate,—for which, perhaps, they are compensated by increased speed,—the males at the same time add to their ornamental characters: the colours become more vivid, and the fringes of long hair on the legs more strongly developed, the adult male of such species as *chelicornis* and *villosa* being quite strikingly handsome. But often, as in *derbiana*, females are more brilliantly coloured than males. Stridulation is only audible to man in the case of the largest nocturnal species, and perhaps does not operate apart from mastication amongst most solifuges. The nocturnal species shew no sexual differences in colour ornamentation, nor in hair development on the legs. It is in fact the general rule in this genus, that all the species exhibiting specialisations of structure or of colour, in one sex or in both, are diurnal in habit: the nocturnal species are all primitive in structure and plain-coloured.

DISTRIBUTION OF SPECIES.

Owing to insufficiency of material, the distribution of the species cannot be profitably discussed except in the case of the genus *Solpuga*. The nocturnal species of *Solpuga* often have a very wide range of distribution. The common species (*S. venator*) of the Karroo and Eastern Province of the Cape extends far into South-West Africa, and another large nocturnal species (*S. monteiroi*) in the northern parts of S. Africa seems to extend its range right across the continent from Delagoa to Walfish Bay. The common species of Johannesburg (*S. schönlandi*) occurs also at Kimberley, and in the Eastern Province of the Cape.

The diurnal species on the other hand have usually a very limited distribution. Two diurnal species are only known from the Cape Peninsula. No one species is known to range from the Transvaal to the Cape, and the species found near Pretoria and Johannesburg (*S. hostilis*) does not extend so far as Kimberley or Bloemfontein. In *Das Tierreich*, Kraepelin records *S. marshalli* from Mashonaland and from Durban, but this is no doubt incorrect. A partial exception to the general rule is found in species which occupy a large area of more or less uniform conditions. The handsomely coloured *S. chelicornis* thus ranges from Namaqualand to the karroid regions of Eastern Cape Province, though it seems more than likely that this species is not uniform throughout, but composed of a number of structurally distinct forms. *Solpuga hostilis*, again, enjoys a fairly wide distribution over portions of the high and middle veld of the Transvaal and of adjoining parts in Natal. A still more extensive range has been indicated for *S. sericea* Poc., the type of which came from Mashonaland, and which has since been recorded from the Zoutpansberg district by Dr Purcell, and from several localities north of the Zambesi by Mr Hirst: but this case is not so anomalous inasmuch as the species, though diurnal in habit, nevertheless belongs to the large primitive group which includes all the nocturnal species.

When the species have been arranged into so many natural groups,

according to their structure, it is of interest to see how those groups are distributed in nature. It is important however to guarantee the accuracy of the scheme as an index to genetic affinity, and for this reason the data presented by the more specialised class of diurnal species can be more safely used than that of the primitive nocturnal species.

A large natural group of nine species, including *hostilis*, *marshalli* and *derbiana*, ranges over Southern Rhodesia, Transvaal, Bechuanaland Protectorate, Free State, Natal and Eastern Cape Colony: it does not occur in Western Cape Colony, the western limit, at present known, being at Somerset East. A small group somewhat related to this, but distinctly separated therefrom in structure, includes only the Capetown species *S. vincta*, the Little Namaqualand species *S. spectralis*, and another western form *S. maraisi* found at Worcester and Stellenbosch. Another small group, also related to the two just mentioned, includes *erythronota* of unknown locality, *erythronotoides* from Victoria West, and *lateralis* from the districts of Uitenhage, Port Elizabeth, and Bathurst. A fourth group of diurnal species, ranking as a well-marked section, includes the two species *chelicornis* and *villosa*, which range throughout the karroid regions of the Cape into Little Namaqualand.

In addition, there are two other groups of diurnal species, neither of which is directly related to those already mentioned. One of them includes *hastata* and two other species which are all from Great Namaqualand, and no member of the group is known to occur elsewhere. Lastly, the very distinct section comprised by *lineata* and its ally *brevipalpis*, occurs widely distributed in the western and central districts of the Cape, excluding the Cape Peninsula: eastwards, its limit appears to be Alice-dale. All these diurnal groups seem to be peculiarly S. African, having, so far as we know, no representatives north of the Zambesi.

It will be seen therefore that the subcontinent is thus divided up into so many distinct regions, each of which is the home of one particular natural group and that for the most part these regions do not overlap. An exception to this generalisation is presented in the case of the *lineata* group, which occupies almost the same region as *chelicornis*. The rule, however, only applies to groups which are sufficiently closely related: *lineata* is so remote in structure from *chelicornis* as almost to warrant generic separation therefrom.

It is interesting to notice that these geographical regions coincide—but not rigidly so—with the regions occupied by the natural groups of other animals, belonging even to different phyla of the animal kingdom. The eastern area, occupied by *hostilis* and its immediate allies, is the same as that occupied by the *glabrifrons-latimanus* group of the scorpion genus *Opisthophthalmus*: the nearest allies of this group are: *austerus*, a Karroo species which agrees fairly with *S. chelicornis* and *villosa* in its range: *macer*, a western species which occurs near Capetown extending northwards as far as Worcester and Ceres, and eastwards for some distance along the Cape Coast: *crassimanus* which occurs in Little Namaqualand and Carnarvon, and *nitidiceps* its close ally which occurs in the Albany, Uitenhage, Somerset East and Cradock districts. The almost universal change of fauna experienced in passing through the Cape

Province from east to west is exhibited in more simple fashion by the water frogs: the species found at Grahamstown is *Rana angolensis*, the same as occurs throughout the Transvaal, Natal, and Rhodesia: quite a different species occurs at Capetown, viz. *Rana fuscigula*, which is characteristic of the western half of Cape Province.

Again, just as each group of species has its own particular area of distribution, so also each individual species seems to have a special part of each large area for its sole occupation. So far as is known, two diurnal species of *Solpuga* never occur together, except in the case of species which are very distantly related. This fact may perhaps be held to witness against the mutation hypothesis of species formation so far as this group is concerned.

Amongst the numerous more primitive species of *Solpuga*, only a few natural groups can be recognised with certainty. The northern section of black-striped forms includes *sericea* of Mashonaland, Zoutpansberg district, and N. Rhodesia, *celeripes* of Salisbury, *striata* of Damaraland and *zebrina* of the Taru desert in British E. Africa. The well-marked section comprising *cervina*, *collinita*, and *alcicornis*, belongs to the western half of the subcontinent, being known from Clanwilliam, Namaqualand, Willowmore, Keetmanshoop and Kuruman. An equally distinct group is that of *strepsiceros*, *spiralicornis*, and *serraticornis* which occurs in S. Rhodesia, Zoutpansberg and Barberton districts; but, a near relative of *serraticornis* is the species *S. schlechteri*, found in Bushmanland and Great Namaqualand: other species apparently referable to this section range far into tropical Africa, one of them *keyserlingi* (perhaps a synonym of *schweinfurthi*) being known to me from N. Nigeria. The group including *schönlandi*, *ferox*, *globicornis*, and *sagittaria*, which is doubtfully natural, seems to range almost over the same area as that occupied by the *hostilis-derbiana* group but it has relationships with central African species, for *S. niassa* seems to be an ally of *schönlandi*. The species *venator*, *lethalis*, *lethalis rectus*, and *furcifera*, are undoubtedly closely related and belong essentially to the western portion of the subcontinent, *venator* extending into the karroid region of the Cape. The precise relationships of the other species, and the inter-relationships of the above groups, are too uncertain to justify any general conclusions therefrom.

The main facts concerning the distribution of the more familiar genera are given by Kraepelin in *Das Tierreich*. Since the publication of that work, the following new genera have been described from S. Africa by Dr Purcell: *Melanoblossia*, *Lipophaga*, *Toreus*, and *Chelypus*. So far as we know, they are all restricted to Southern Africa, as also is the genus *Hexisopus*: further, all five genera belong essentially to the western region, which includes also the Karroo and Kalahari. At present, not a single species of any of these genera is known to occur in Natal, Transvaal, Free State, or in east Cape Colony

Hemiblossia has been recorded by Pocock from Guatemala, but otherwise is only known from S. Africa: this distribution points to great antiquity for the genus, and is in accordance with its primitive nature.

Of the other genera found in S. Africa, the most widely distributed seems to be *Gluviopsis*, which occurs as far north as Algiers, and extends into Asia Minor, Arabia, Socotra and Western India. *Daesia* also occurs throughout Africa (excluding West Africa, from the Congo basin northwards through the coastal countries as far as Morocco, which regions are all very poor in Solifugae) and extends into Palestine and Arabia.

Solpuga ranges throughout Africa, and *Blossia* seems to have the same range: *Zeriassa* is only known from the tropical parts of South Africa, and from East Africa as far north as Somaliland. *Ceroma* extends from the western region of S. Africa, northwards into East Africa.

Only one genus, *Solpuga*, is known to me from Natal: however Kraepelin has recorded a *Blossia* from "Moritzburg" which, as Pocock suggests, may mean Pietermaritzburg.

The distribution of Solifugae is largely determined by conditions of humidity. They avoid dense forest, but are common in arid regions, and in open bush country, such as that of the Kalahari. I am informed by Mr E. C. Wilmot, who writes from Tsessebe, that a species of *Solpuga* (probably *monteiroi*) may often be seen in the act of climbing trees in search of Cicadas. In the Albany district, they are particularly abundant at Alicedale, a warm locality in the valley of the Bushman's River, where scrub and bush prevail. Mr Frank Cruden has kindly furnished me with the following brief notes on several species found in that locality: *Hemiblossia O'neili* is found on light gravelly soil near the river, on flats broken by occasional thornbushes. They are only seen during the bright sunshine of a summer's day, and then in considerable numbers: they are extremely active, and not easily caught, as they seek refuge in small holes and crevices on the slightest alarm. Specimens may be captured by spraying them with dilute spirits of wine, when the creatures succumb at once.

Blossia unguicornis is never seen in the open during daytime, and when exposed to light immediately seeks cover. They are found under stones on the flats and hill sides.

Solpuga lineatus occurs chiefly among the rhenoster bush and other scrub, but not in dense bush. On a summer's day they may often be seen lying on stones exposed to the sun. They are sometimes found in shallow earth cavities under stones.

Solpuga venator occurs on open flats and in broken scrub land. During daytime it takes cover under large stones, but at night may enter houses.

At Grahamstown I have only found one species, *S. derbiana*. It occurs on the open flats above the town, frequenting grass veld as well as stony lands covered with rhenoster bush and other short scrub. During winter months these creatures hide below ground: they emerge in numbers during the bright sunny days of October. Rapidity of movement is their characteristic habit: they run along the ground: they climb the low bushes with ease, at times swinging from twig to twig like long-limbed apes: they are expert burrowers, using the chelicerae as digging organs. Despite their speed they are said to fall a ready prey to kestrels.

The following notes are taken from a little-known paper entitled "Some Arachnids at Hanover, Cape Colony," by S. C. Cronwright-Schreiner, in the *Popular Science Monthly* for December 1902: "If you watch a *Solpuga* closely, you may see its sides palpitating rapidly, even violently, if you hold it in your hand. Like all active, high strung, quick breathing creatures, the Solifugae perish almost instantaneously when immersed in spirits, while large scorpions and large Harpactirae will live for two or three hours. They are great burrowers, but do not make regular holes apparently, and they lie dormant underground during the winter. They are a feature of the thirsty veld and the blazing sun. The 'Tommies' along the railway sometimes make one of these creatures fight with a scorpion. They place the combatants in some slippery vessel so that they cannot run out. The scorpion is nearly always much the larger and heavier and has in addition to its long arms and powerful nippers, a deadly sting. Yet it not infrequently happens that the jacht-spinnekop comes off victorious, for it seizes the scorpion in its terrible shears and tears a huge hole in it with a quickness and force against which the scorpion is often powerless. When one first sees a *Solpuga* on the veld, especially the commonest (*S. chelicornis*), one can hardly believe it is not a beautiful karoo flower: touch it, and away it darts. The Dutch call them Jacht Spinnkoppen or Haar Scheerders. Jacht Spinnkop (hunting spider) is a very appropriate name, for, to the casual observer they resemble spiders, and they are mighty hunters. Haar Scheerder (hair shearer) is even more appropriate. They are called Haar Scheerders because of their two enormous shears. Many a person believes that, if they get into your hair, you will not get them out again until they have shorn it all off."

The S. African solifuge fauna is noteworthy for the abundance of diurnal types. Text-books of Zoology and Natural History describe these creatures as wholly nocturnal, and indeed this seems to be actually the case in other parts of the world. In Dr F. Werner's paper on "Scorpions and Allied annulated spiders of the Anglo-Egyptian Sudan" and in Mr Pocock's account in the *Fauna of British India*, the whole fauna is represented as nocturnal.

The following arrangement of the subfamilies and of the several genera in each subfamily has no claim to phylogenetic importance. The subfamily Solpuginae seems to be quite sharply separated from the other groups and I regard it as the most specialised. The Daesiinae constitute a natural group of which *Daesia* is probably the most specialised genus: this subfamily presents certain points of affinity with the Galeodidae. The Karschiinae have relationships therewith, yet are well worthy of distinction in my opinion, although Prof. Kraepelin finds difficulty in separating them from the Daesiinae: the subfamily includes the most primitive of S. African Solifugae, and indeed the genus *Lipophaga* would appear to be the most generalised of all known Solifugae. The very specialised Hexisopodinae are somewhat isolated and their affinities obscure but it does not seem necessary to separate them as a family distinct from the Karschiinae and Daesiinae.

Key to the Genera of South African SOLIFUGAE.

A. Fourth leg with a pair of well-developed terminal tarsal claws. These claws are somewhat larger than those on the preceding legs. The femora of the legs are all long, much longer than the trochantin.

a. First leg without tarsal claws¹.

a₁. Tarsus of fourth leg with seven segments, of which the basal one is by far the longest, being quite as long as the next four segments together, the three penultimate segments being the shortest: tarsi of second and third legs with only four segments: subungual appendages of the tarsal claws small and not strongly divaricating. *S. f. Solpuginae.*

Subfamily SOLPUGINAE.

1. Tarsus of palp immovably attached to the tibia, which segment becomes somewhat narrowed distally and on its inferior surface is armed with numerous short truncated bristles and longer pointed ones but no true spines, also in the male often with a very distinct scopula of short feathered hairs: coxa of palp with an elongated maxillary process projecting anteriorly from the ventral border mesially: ocular tubercle bearing a number of stiff bristles or weak spines, several pairs of approximately equal size being directed anteriorly (in juveniles one pair of forwardly directed spines is noticeably larger than the others): anterior border of head-plate straight and the mesial longitudinal groove more or less obsolete in adults: the glabrous area on the mesial surface of the basal part of the chelicera bearing a series of parallel stridulatory ridges, which however are occasionally absent in adult males: the dental series of the upper jaw flanked on the inner surface and sometimes almost hidden by a strip of numerous feathered bristles, and parallel thereto but situated at a little distance posteriorly is a row of forwardly directed sharp-pointed stout spines, usually 7-9 in males, but more numerous in females: dentition of upper jaw variable in the single series, but the lower jaw has always two large teeth with one (rarely two or three) intervening small tooth; surfaces of body hairy, with stiffer setae on the chelicerae and head-plate; in the male long spines often occur on the chelicerae, but never on the tergites: flagellum of adult male with a stiff shaft exhibiting great variety in shape, generally cylindrical or more or less flattened into a ribbon; this arises from the basal enlargement, a hollow closed capsule, usually flat on the mesial side and turgid on its external side, and fixed immovably along its base to the upper or inner surface of the upper jaw: the walls of the capsule are thickened along the dorsal and hind margins, and the cavity is continued as a fine tubule into the procurrent portion of the shaft which remains firmly attached to the surface of the jaw up to the point where the shaft bends upwards. (Species usually of large size.)

Solpuga Licht.

2. Similar to *Solpuga*, but the tibia of the palp in the adult male carries a number of stout spines on its inferior surface as well as a scopula, which is not large: ocular tubercle armed with two semicircular series of stiff bristles, the two largest of which project horizontally forwards.

Zeriassa Pocock.

¹ According to Kraepelin, rudimentary claws may occur in *Glwiopsis*.

*a*₂. Tarsus of second and third legs with 1-2 segments, of fourth leg with 1-4 segments. Stridulatory ridges of chelicerae long and well developed. Flagellum of male when present is membranous and expanded, at least in its basal portion, the edges incurved to form an open capsule: at the base where it is attached to the mesial surface of the jaw, there is a ball and socket joint by which it can be movably articulated in a vertical plane around its point of attachment. Anterior border of head-plate not quite straight but more or less curved. *S. f. Daesiinae.*

Subfamily DAESIINAE.

3. Second and third legs with two tarsal segments, fourth leg with four tarsal segments, the basal one of which is subequal to the other three in length, the one next to it being shortest, and the most distal segment longer than the penultimate or the antepenultimate. Tibia of second leg with five dorsal spines, of third leg with three dorsal spines. Tarsus of palp slightly movable. Tibia of palp without cylinder bristles or scopula inferiorly but with short spines on each side, three externally and 1-3 internally as well as several longer weak spines and bristles. Maxillary process of coxa of palp very short and rounded. Dentition of female very like that of *Solpuga venator*: of male very variable. The surfaces of the body are not spiny but covered with hairs and long setae which may be spiniform on the upper surface of the chelicerae and on the hind border of the head-plate of adult males. Adult male with a rotatable flagellum, and with a group of numerous modified hairs on the second sternite. Species of moderate size and plain colouration, strongly contrasting colours being unknown in this genus. *Daesia* Karsch.

4. Tarsus of second and third legs composed of only one segment, of fourth leg comparatively long and slender, composed of two segments the distal one of which is much the shorter and is quite freely movable. Tibiae of second and third legs without a dorsal row of spines. Head-plate with a very distinct mesial groove, and armed usually with short spines, prickles, and forked bristles, whilst the upper surfaces of the chelicerae and the tergites, especially those of the thorax, are armed with stiff setae and cylinder bristles the longer ones of which are forked at the tip, or in the male with spines which are often very strong, the first thoracic tergite constituting a narrow spiny collar to the head-plate. Ocular tubercle with two stiff bristles projecting horizontally forwards. Tibia of palp inferiorly with spines and numerous cylinder bristles: short cylinder bristles, or long ones forked at the tip, occur also on the surfaces of the body and appendages generally. Maxillary lobe of coxa of palp fairly long and prominent. Adult male with a membranous rotatable flagellum, and there are several pairs of modified fleshy hairs on the second abdominal sternite in the male and sometimes also in the female. Species of small size and plain colour (except *B. obscura*). *Blossia* Simon.

5. Similar to *Blossia*, but flagellum of male is a flexible densely hairy rod, not rotatable but directed forwards and hidden between the chelicerae. Patella and tibia of palp without spines inferiorly. Ocular tubercle with a semicircle of fine setae on the mesial side of each eye. Anterior margin of head-plate almost semicircular. Upper jaw of male strongly compressed laterally, forming a vertical lamina except quite at the base. *Melanoblossia* Purcell.

6. Tarsus of fourth leg comparatively stout, especially in the female, with one or two segments, but in the latter case the two segments are subequal in length and not movably articulated with each other. Patella and tibia of palp without true spines below, the tibia being thickly studded all round with brownish black truncated cylinder bristles. Chelicerae of male without spines above, but with long slender curved bristles. Flagellum of male a large flat rigid membrane rotatable at its narrow end, bearing on its mesial surface a delicate capsule with long slit-like opening, and terminating at its broader end in slight exfoliations, two of which are more or less like short horns: second and third sternites with numerous fleshy hairs. Species of small size and with strongly contrasting colours. *Hemiblossia* Kraepelin.

7. Similar to *Hemiblossia*, but patella and tibia of palp in both sexes with stout spines below in a double row. Tarsus of fourth leg comprising only one segment, which is comparatively slender (5-6 times as long as deep). Flagellum membranous, forming an inflated capsule open along its mesial side. Second and third sternites of male each bearing two clusters of several modified fleshy hair structures. *Gluiopsis* Kraepelin.

b. Tarsus of first leg with a pair of small or minute tarsal claws. Flagellum of male when present rotatable (or fixed apparently in some species). *S. f. Karschiinae*.

Subfamily KARSCHIINAE.

8. Tarsi of legs II-IV with two freely movable segments, the basal one five or six times as long as the distal segment, which has very long, strongly diverging, subungual appendages. Tibiae of legs II and III spined dorsally, but leg IV without spines. Tibia of palp more or less cylindrical, not attenuated distally, and without true spines or scopula inferiorly, the patella with five very long bristles on each side inferiorly. Upper surfaces of chelicerae and body without strong spines. Anterior margin of head-plate rounded. Ocular tubercle armed with a number of fine bristles especially in front. Basal enlargement of flagellum small and not very sharply differentiated from the shaft, attached by a fairly large rotating joint (sometimes fixed?) to the inner surface of the jaw, and produced directly upwards into the shaft: basally, it is protected and more or less concealed on the mesial side by a fan-like row of feather bristles or by several spines. Upper lobe of rostrum evenly pointed at the apex, the lower margin being not horizontal but inclined upwards. Coxa of palp with a short maxillary process. *Ceroma* Karsch.

9. Similar thereto, but adult male without a flagellum. Upper lobe of rostrum unevenly pointed, the lower margin being horizontal and very slightly concave, and the upper margin curving strongly downwards. *Toreus* Purcell.

10. All the legs with a single tarsal segment and small pulvillus. The two halves of the genital sternite of the female not united mesially. Adult male without a flagellum and no fleshy hairs on the second abdominal sternite. Patella of palp with strong spines inferiorly in the male: tibia of palp with numerous truncated cylinder bristles inferiorly especially in the male. Ocular tubercle with a pair of spines anteriorly. Tibia of leg IV with slender spines inferiorly in the male: of legs II and III with four or five stout dorsal spines also. *Lipophaga* Purcell.

B. Fourth leg without tarsal claws. All the legs are short, the posterior three pairs very robust, their more distal segments strongly spined. In the fourth leg the combined length of coxa and of the three trochanter segments is about equal to that of the rest of the limb, the femur of this leg being shorter than the trochantin. Surfaces of body and appendages clothed with long silky hairs. Flagellum of male rotatably attached at the small cup-like basal enlargement to the inner surface of the upper jaw.

S. f. Hexisopodinae.

Subfamily HEXISOPODINAE.

11. The three distal segments of leg IV are terete, or only slightly compressed, and without angular edges. Pedipalps not spined. Stridulatory area of chelicerae with parallel ribs. In females, the mesial surface of the chelicera carries feathered bristles and stout simple bristles, but the males are devoid of feather bristles and have no long simple bristles, though dorsally near the base of the fang there occurs a dense patch of short spiniform setae. The flagellum of the male is hidden between the mandibles, being attached to the jaw far back, but quite near to the cutting edge and not far from the angle of the jaws.

Hexisopus Karsch.

12. The three distal segments of the fourth leg are broad and more or less strongly flattened with angular edges, and some of the distal segments of the third and fourth legs have their posterior surfaces hairless and densely covered with short granuliform or dentiform spinules. Distal segments of pedipalps strongly spined. Inner surface of chelicerae with a large smooth area marked with fine furrows, which are sometimes more or less reticulately arranged, and sometimes more or less in longitudinal lines. (Females of this genus unknown.)

Chelypus Purcell.

Genus Solpuga Licht.

Solpuga lethalis C. L. Koch, 1842 [Text fig. 2 a]. Kraepelin, in *Das Tierreich*, p. 56, fig. 14. Purcell, in *Annals S. Af. Mus.* 1, p. 405, figs. 19 and 19 a.

The form described by Dr Purcell, characterised by a well-marked distal sinus on the shaft of the flagellum, was recorded from the following divisions in Cape Colony: Malmesbury, Robertson, Swellendam, Paarl, Worcester, Clanwilliam and Namaqualand. In this form, now termed *S. lethalis typicus*, the shaft is devoid of minute serrations except for an oblique band on the anterior half of the sinus.

Kraepelin records the species from various localities in S.W. Africa, viz. Ababis, Okasise, Okahandja, Windhuk, Rehoboth and Spitzkoppe near Keetmanshoop. It is not known from the eastern or central districts of the Cape Province.

In the male, the spines on the upper surfaces of the chelicerae are not very stout.

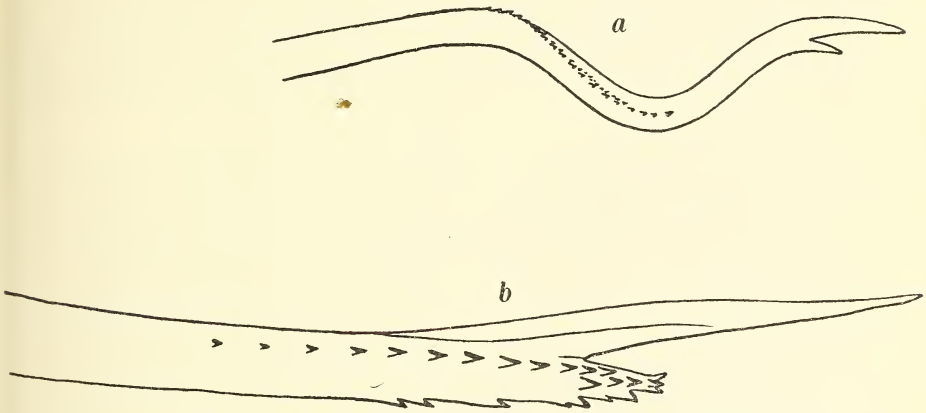
Solpuga lethalis C. Koch var. nov. *rectus* [Pl. VII, fig. 37 and Text fig. 2 b].

This name is applied to a form which is chiefly distinguished from typical specimens, as described by Kraepelin and Purcell, in the complete absence of a distal sinus on the recurrent portion of the flagellum. The shaft is long,

extending back well beyond the ocular tubercle, approximately reaching the middle of the head-plate: apically it is bifurcated, the upper portion being longer, quite smooth and tapering to a point, the lower portion being short, blunt, and its surfaces well serrated along the angular margins. The shaft is also serrulated along the slight ridges which occur in its basal half, but in the distal half, where ridges are still more marked, the serrations are absent excepting near the apex: the surfaces are in fact comparatively smooth in the distal half but roughened in the basal half.

The anterior bend of the flagellum is approximately midway between the apex of the fang and the first tooth. On the inner upper margin of the fang, near to the anterior bend, there is a small tooth.

Measurements. Breadth of head-plate 11, length of patella of palp 17.8, of tibia and tarsus of palp 17.5, of patella of fourth leg 16. Total length of recurrent portion of flagellum 16.75.



Text fig. 2, *a* and *b*. *Solpuga lethalis* Koch. *a*, Distal portion of flagellum of typical form from O'okiep, viewed from the outer side inferiorly. *b*, Ditto of *S. lethalis* var. nov. *rectus* from Windhuk: more enlarged than *a*.

The type of this variety is a single male example from Windhuk (G. A. Thompson), in the collection of the Transvaal Museum.

This form was evidently known to Prof. Kraepelin: in his last paper (3) some reference was made to the variability of the flagellum in this species and *venator*, but unfortunately no locality data were given for the varietal forms there mentioned.

Solpuga venosa Purcell, 1899. *Annals S. Af. Mus.* 1, p. 412, figs. 18 and 18 a. Kraepelin, in *Das Tierreich*, p. 74, fig. 41.

The type was taken from a locality about twenty miles east of Pietersburg, Zoutpansberg dist.

Solpuga furcifera Kraepelin, 1899. *Das Tierreich*, p. 79, fig. 56.

Kraepelin cites the following localities in the northern parts of S.W. Africa: Osire, Windhuk, Rehoboth, Walfish Bay. A description of the female is given by the same author (2).

Solpuga fusca C.L. Koch, 1842 [Pl. VI, fig. 26]. Purcell in *Annals S. Af. Mus.* 1, p. 417, figs. 22 and 22 a. Kraepelin in *Das Tierreich*, p. 79, fig. 54.

This species is recorded by Purcell only from localities in the Cape Peninsula. It may be noted that Kraepelin's figure in *Das Tierreich* does not agree with Dr Purcell's account in regard to the position of the anterior bend of the flagellum.

Solpuga toppini Hirst, 1916. *Annals Durban Mus.* 1, p. 228, fig. 15.

The type is from Ngxwala Hill, Ubombo, Zululand.

The Durban Museum has several large females from the same locality which are probably referable to this species. The general colour in spirits is a dirty brown with olivaceous tinge, the chelicerae especially somewhat greenish, tergites all blackish, malleoli dark-edged. The single series of teeth in the upper jaw with two small intermediate teeth. Genital sternite with broadly rounded posterior margins. There is a stronger development of fine hairs on the palp and legs than in females of the *venator* group, and the head-plate is rather more hirsute. Measurements: breadth of head-plate 12.5, length of tibia and tarsus of palp 11, of patella of palp 10.3, of patella of fourth leg 10.2, of tibia of fourth leg 9. These females are well separated from those of *fusca*, to which *toppini* seems to be related, in that the dentition of the lower jaw is quite normal for the genus.

Solpuga venator Pocock [Pl. I, fig. 1 and Pl. IV, fig. 12], 1897. *Ann. Mag. Nat. Hist.* 6, xx, p. 258, fig. 7. Purcell in *Annals S. Af. Mus.* 1, p. 407 and 11, p. 208.

The type of this species came from Kleinpoort in the Eastern Karroo, and specimens from Port Elizabeth were identified therewith by Mr Pocock.

Recorded by Purcell from the following divisions in Cape Colony: Namaqualand, Kenhart, Carnarvon, Victoria West, Middelburg, Beaufort West, Prince Albert, Sutherland and Uitenhage; also from Warmbad in Great Namaland. It is known to me from: Brakkloof near Grahamstown (Mrs G. White); Alice (Albany Mus. coll.); Grattans, Koonap (E. Bennett); Carlisle Bridge (F. Bowker); Alicedale (F. Cruden); Longhcepe (Miss D. Cotton); De Aar (S. C. Cronwright-Schreiner); Griquatown (Dr R. Broom); Aus S. W. A. (female examples in Kimberley Mus.). Kraepelin records it from the following localities in S. W. Africa: Warmbad, Churutabis, Keetmanshoop, Kabus, Kuibis, Luderitzbucht, Gibeon and Rehoboth.

The spines on the upper surface of the chelicerae are not so strongly developed as in *monteivoi*. A large female from Keetmanshoop (G. V. Haagner), in the collection of the Transvaal Museum, has the following measurements: Width of head-plate 15, length of patella of palp 16, of tibia and tarsus of palp 17, of fourth patella 14.75, of fourth tibia 13.3. This specimen has a single intermediate tooth in the single series of the upper jaw. In a male from Dunbrody the single series of teeth in the upper jaw comprises four main teeth, but on the fourth basally there is a distinct additional tooth: in specimens from Redhouse a minute additional tooth occurs between the second and third normal teeth. A large female example from Griquatown sent along with an adult male of *venator* has two such intermediate teeth, whereas the male has only one: this female may be referable to *lethalis*, but the dentition cannot be regarded as an infallible guide in distinguishing these two species.

A female from Douglas has a single intermediate tooth; males from the same locality may have one such tooth or two, in which case one of them is very small.

Solpuga monteiroi Pocock, 1895 [Pl. VII, fig. 38]. *Ann. Mag. Nat. Hist.* 6, xvi, p. 87. Pl. IV, fig. 6 (figure erroneous). Also *Ann. Mag. Nat. Hist.* 6, xx, p. 257, fig. 6 on p. 261.

The author's second figure was also incorrect in its representation of the spiny armament of the chelicera.

The type came from Delagoa Bay. Kraepelin records it from Walfish Bay, and from other localities in the northern portion of South West Africa, viz. Windhuk, Okahandja, Okakena, Osire, and Grossfontein. I have recorded it from Victoria Falls, and it is also known to me from: Mt Temple, Bechuanaland (T. C. Lanham); Rooikranz, Rustenburg dist. (Transvaal Mus.); Vygeboompoort in Waterberg dist. (G. van Dam); Tsessebe (E. C. Wilmot); Kraai Pan (Kimberley Mus.); Griffin Mine, Leydsdorp (G. van Dam); and Newington in N. E. Transvaal (Dr J. P. Fenoulhet).

The distribution of this species appears to agree closely with that of the scorpion *Uroplectes vittatus* Thor.

Specimens from Mt Temple have a straight flagellar shaft, whilst those from Tsessebe have a shallow sinuation thereon at a little distance from the apex. In one example from the former locality, the basal enlargement of the flagellum is not so elongate as in typical examples and the spines on the chelicerae not so strong.

Female examples apparently referable to this species are distinguishable from those of *venator*, *globoicornis*, and allies, from the fact that the patella and tibia of the fourth leg are subequal in length: moreover the cylinder bristles on the palp are comparatively few, the tarsus being devoid thereof and the femur having only very few such bristles.

Solpuga schlechteri Purcell [Pl. IV, fig. 15], 1899. *Annals S. Af. Mus.* i. p. 411, figs. 17 and 17a.

The type came from Naroep in Great Bushmanland. In *Das Tierreich*, Prof. Kraepelin suggested that this may be cospecific with *serraticornis*: it is clear however that such is not the case, and in Kraepelin's most recent list the species is maintained on the evidence of specimens from Luderitzbucht and Kuibis, which differ from Purcell's description only in possessing a single intermediate tooth, instead of two, in the upper jaw. We have the species from Kakamas (Miss H. C. Olivier), and from Keimoes near Upington (S. M. Gadd). In the Keimoes example there is a single intermediate tooth in the upper jaw: in the Kakamas specimens two such teeth are represented, although the second tooth is either a mere rudiment or only minute.

The feather bristles of the upper jaw are not strongly developed: they are comparatively numerous on the lower jaw.

Solpuga serraticornis Purcell, 1899. *Annals S. Af. Mus.* i. p. 409, fig. 16.

The type came from the neighbourhood of Bulawayo.

Adult specimens from Bulawayo have been kindly lent to me by Dr G. Arnold. In both sexes the dorsal surfaces are somewhat infuscated, but not deeply so, the pigmentation extending over the soft skin for some little distance lateral to the tergites. In the male the spines on the upper and lateral surfaces of the chelicerae are numerous and long, but not very stout: the upper margin of the basal enlargement of the flagellum is curved, not greatly elongated.

In the female there are two intermediate teeth in the single series of the upper jaw: cylinder bristles occur on the patella, tibia, and tarsus of the palp, but not many on the patella.

Measurements of adult female. Breadth of head-plate 14, length of patella of palp 12, of tibia and tarsus of palp 12.5, of patella of fourth leg 11.2, of tibia of fourth leg 10.1.

A variety of this species, found at Umtali, was described by me under the name of *S. serraticornis umtalica* (*Annals Transvaal Mus.* iv. p. 162, fig. 24). We also have the species from a locality in the south of the Melsetter dist. (F. A. O. Pym).

In *umtalica* the upper margin of the basal enlargement of the flagellum is curved: there are numerous well-feathered bristles on the lower jaw, and the distance from the tip of the fang to the apex of the first tooth is equal to $1\frac{1}{3}$ – $1\frac{2}{3}$ times the distance between the two large teeth: there is a dense group of long and strong spines on the upper and outer surfaces of the chelicera.

Solpuga spiralicornis Purcell [Pl. V, fig. 18], 1903. *Novitates Zoologicae*, x. p. 304, fig. 1.

The type came from Shilowane, near Leysdorp. What seems to be the same species was described by Mr S. Hirst from the Zoutpansberg dist., under the name of *S. pugilator* (*Ann. Mag. Nat. Hist.* 8, ix. p. 232). It is known to me from Newington (Dr J. P. Fenoulhet), and the Transvaal Museum has it from Hectorspruit (F. Streeter), and Griffin Mine, Leysdorp (G. van Dam).

In this species the form of the basal enlargement varies somewhat. In the Newington specimen the upper margin of the basal enlargement is quite long and practically straight: in the Griffin Mine example it is a little shorter, and distinctly curved on the upper margin. Moreover, in the latter, the terminal portion of the shaft beyond the sinus is not so sharply pointed nor so straight as in our Newington example. The Griffin Mine form is presumably typical: that from Newington and Hectorspruit is apparently the same as *pugilator* Hirst, which may thus rank provisionally as a varietal form.

The characters of the lower jaw, however, seem to separate these forms a little further: in the Newington example, the fang is distinctly longer than in other specimens, the distance from the tip to the apex of the first tooth being equal to $1\frac{1}{2}$ times the distance between the apices of the two large teeth, whereas in examples from Griffin Mine and Hectorspruit the proportion is $1\frac{2}{3}$ times. In each case there are numerous well-feathered bristles on the lower jaw.

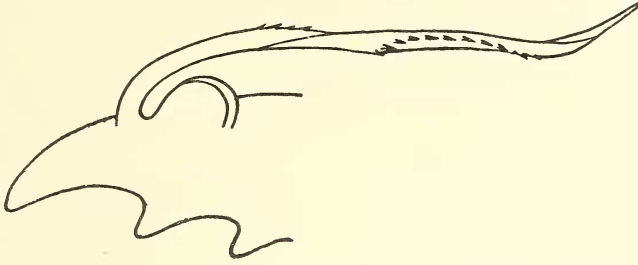
A female example probably referable to *spiralicornis* was also taken at Griffin Mine by Mr van Dam: I refer it to this species, rather than to *monteivori*, which was taken in the same neighbourhood, on account of the dark pigmentation on the abdomen, a character found in the male of *spiralicornis*. The soft skin between the tergites of the abdomen and thorax is rather deeply infuscated, and on the abdomen this extends to some extent down the sides in the neighbourhood of the first three or four segments: in the hinder half of the abdomen the soft skin of the sides is deeply infuscated over an extensive area and also ventrally between the sternites. The head-plate is brown, dark brown near the anterior margin, the ocular tubercle very darkly so. Palps and legs pale yellowish brown. Malleoli not infuscated. There are two intermediate teeth of moderate size in the single series of the upper jaw.

Measurements. Breadth of head-plate 9.25, length of tibia and tarsus of palp 11, of patella of palp 10.35, of tibia of fourth leg 9.3, of patella of fourth leg 9.7.

Solpuga strepsiceros Kraepelin, 1899 [Pl. IV, fig. 13 and Text-fig. 3]. *Das Tierreich*, p. 68, fig. 31.

The locality cited by Kraepelin is Delagoa Bay. The species is known to me from Barberton (Transvaal Mus.).

In Barberton specimens, the flagellum has a spiral twist, but the spiral is not an open one, and the curves not so pronounced as represented in Kraepelin's figure in *Das Tierreich*. The serrated edge is not continued over the whole length of the shaft, but commences slightly posterior to the hind margin of the basal enlargement. Basal enlargement short, with curved upper margin. On the upper surface of the chelicera there are a few long slender spines and stiff bristles, but the development of stout spines is not nearly so pronounced as in *spiralicornis*, and true spines do not occur on the outer surface of the chelicera.



Text fig. 3. *Solpuga strepsiceros* Kraepelin. Shewing terminal portion of right upper jaw, with flagellum: specimen from Barberton.

The splendid colouration of this species—head-plate, palps, legs and sides of abdomen clothed with bright, golden yellow hairs, tergites black—serves to distinguish the female from those of related species. The margins of the malleoli are broadly infuscated but not deeply so. The measurements of the female are as follows: breadth of head-plate 10·7, length of tibia and tarsus of palp 10, of patella of fourth leg 9, of tibia of fourth leg 7·8.

Solpuga schönlandi Pocock [Text-fig. 4], 1900. *Ann. Mag. Nat. Hist.* 7, vi. p. 316.

The type was recorded from Grahamstown, but there are no specimens in the Albany Museum from the Grahamstown neighbourhood. I have previously recorded it from Kimberley, from the neighbourhood of Johannesburg, and from several localities in the Pretoria district. It is also known to me from Rooispruit near Rosmead (A. Gibbons); Tafelberg (Miss A. Gadd); Damplaats near Burghersdorp (A. Kruger); Vryburg, Warrendale and Kuruman (Kimberley Mus.); Modder Riv. (F. A. O. Pym) and Bulawayo (Miss L. Leppan).

In the male, there may be either five or four teeth in the single series of the upper jaw: in the former case the third tooth is minute. The terminal fang is rather long, curved slightly outwards towards the apex, and a little downwards at the apex: on the inner edge superiorly is a small sharp-pointed forwardly projecting tooth, situated much nearer to the flagellum than to



Text fig. 4. *Solpuga schönlandi* Pocock. Portion of left chelicera of male, viewed from mesial side: specimen from Rooispruit.

the apex of the fang. The lower jaw has no distinct lateral keel on its outer side distally: the distance from the tip of the fang to the apex of the first tooth is about equal to $1\frac{1}{2}$ – $1\frac{2}{3}$ times the distance between the apices of the two large teeth. The basal enlargement of the flagellum is high, not produced anteriorly: the upper margin is acute, but does not form a sharp keel well marked off from the outer turgid portion: on its outer side it is flanked by a strong chitinous thickening which is continued obliquely downwards into the fang. The shaft is short, lightly curved, considerably flattened at the anterior bend in an antero-posterior direction, but elsewhere is more or less cylindrical, gradually diminishing in width towards the apex, which is truncate with a central projecting core. In dried specimens the shaft bends downwards over the basal enlargement, and thus the apex becomes carried far back, distinctly behind the hind margin of the basal enlargement. There is a fairly strong development of spines and stiff bristles on the upper and outer surfaces of the chelicera. Colour: head-plate and appendages pale yellowish, the front margin of the former infusate: abdominal tergites pale brown: malleoli not infuscated.

The female has four or five teeth in the single series of the upper jaw: upper and lateral surfaces of the chelicera more or less distinctly marked with three darkish longitudinal stripes: hairs of abdomen greyish. This latter character will separate it from the female of *venator* in which the hairs of the abdomen are uniformly lemon yellow.

So far as I can discover, the female presents no structural or colour characters which will serve to distinguish it from *glocicornis* which is common in the Pretoria district, or from *ferox* which occurs in the Free State and Transvaal. However, the relation between the width of the head-plate and the length of the several segments of the fourth leg may perhaps ultimately furnish a guide to the specific identity of adult examples.

Measurements. Total length, M, 41: width of head-plate, F, 12.85: length of tibia and tarsus of palp, M, 13.5, F, 11.85: of patella of palp, M, 13, F, 10.8: of tibia of fourth leg, M, 10.8, F, 9: of patella of fourth leg, M, 11.2, F, 9.6.

Solpuga glocicornis Kraepelin, 1899 [Pl. V, fig. 21]. *Das Tierreich*, p. 76, fig. 47.

This species has been previously recorded by me from various localities in the Pretoria district, and with some doubt from the Lydenburg and Zoutpansberg districts.

In the lower jaw of the male the distance from the tip of the fang to the apex of the first tooth is equal to about $1\frac{2}{3}$ times the distance between the apices of the two large teeth.

In the female, the patella of the fourth leg seems to be always longer than the tibia.

Measurements of several females apparently referable to this species are as follows:

	Width of head-plate	Length of tarsus + tibia of palp	Length of patella of palp	Length of patella IV	Length of tibia IV
Immature example from Pretoria	10.9	11.3	10.4	9.5	8.8
Adult from Gezina	12.1	12	11.25	10	9.4
Adult from Wonderboom	12.5	11.8	10.65	9.7	9.3

Only very few cylinder bristles occur on the tibia of the female palp: there are some also on the tarsus.

Solpuga sericea Pocock [Pl. III, fig. 6], 1897. *Annals Mag. Nat. Hist.* 6, xx. p. 260, fig. 4.

The types came from Gadzima on the Umfuli River, Mashonaland. Mr S. Hirst records the species from Petauke and from Alala Plateau, localities north of the Zambesi. It is recorded by Dr Purcell from Shilowane.

We have a female example from Salisbury (Fr. J. O'Neil, S.J.) which is probably referable to this species (or possibly to *celeripes* Hirst). There are numerous very long silky hairs on the hind legs, a very unusual character in females: the hairiness of the hind legs is indeed more pronounced than in females of *chelicornis*. The hind borders of the genital sternites are broadly rounded. There are two intermediate teeth in the single series of the upper jaw. Measurements: breadth of head-plate 5.1, length of tibia and tarsus of palp 6.1, of patella of palp 5.5, of patella of fourth leg 5.7, of tibia of fourth leg 5.7.

Solpuga celeripes Hirst [Pl. VI, fig. 32], 1911. *Manchester Memoirs*, LVI. No. 2, p. 10, fig. 2.

The type came from Salisbury, S. Rhodesia. The adult male is the smallest known to me in this genus, the type being 11 mm. long and its head-plate 3 mm. broad. A specimen in the Transvaal Museum has the following measurements: breadth of head-plate 3.1, length of tibia and tarsus of palp 5.7, of patella of palp 5.4, of tibia of fourth leg 5.7, of patella of fourth leg 5.3.

In describing the species, Mr Hirst remarked that the dark markings and general colouration are almost exactly the same as in *S. sericea*, but the narrow yellow stripe which is present on either side of the dark central band of the dorsal surface of the abdomen in *sericea* seems to be absent (the abdomen being shrunken). In the specimens examined by me, however, the continuous yellow stripes are clearly present. The adult male is remarkable for the relative shortness of the fang of the lower jaw, the distance from the tip of the fang to the apex of the first tooth being subequal to the distance between the apices of the two teeth.

Solpuga alstomi Purcell, 1901. *Annals S. Af. Mus.* II. p. 209, fig. 1.

The type was taken at Eities in Gt. Bushmanland.

Solpuga darlingi Pocock, 1897. *Ann. Mag. Nat. Hist.* 6, xx. p. 259 and fig. 5, p. 261.

The type came from Gadzima on the Umfuli River, Mashonaland.

Solpuga ferox Pocock [Text fig. 5], 1895. *Ann. Mag. Nat. Hist.* 6, xvi. p. 83, Pl. 4, fig. 3. (Kraepelin's figure in *Das Tierreich* (p. 71) represents the characters of the male chelicera more correctly than that accompanying Pocock's original description, but is also somewhat misleading.)

The type is labelled Port Elizabeth, but the record requires confirmation in my opinion. The species has been recorded by me from Kimberley and Rustenburg, and I know of it also from Venterskroon (M. H. Viljoen); Kroonstad (Miss D. Chennells); and Bloemfontein (Dr T. F. Dreyer). The Kimberley Museum has it from Fourteen Streams, Barkly West, Taungs, Pniel, and Wirsing Siding as well as from Kimberley.

The male has a distinct keel on the outer side of the lower jaw distally.

Solpuga sagittaria Pocock, 1900. *Ann. Mag. Nat. Hist.* 7, v. p. 299, figs. 5 and 5 a. See also *Das Tierreich*, p. 74, figs. 42 and 43.

The locality cited for the type is Mazoë, Mashonaland.

Solpuga suffusca Hewitt [Pl. V, fig. 22], 1916. *Annals Durban Mus.* I. p. 217.

The locality of the type is unknown. In both upper and lower jaw there is an exceptionally strong development of feather bristles. The fang of the lower jaw is short, the distance from the tip to the apex of the first tooth being about equal to $1\frac{1}{3}$ times the distance between the apices of the two large teeth.

Solpuga cervina Purcell, 1899. *Annals S. Af. Mus.* I. p. 415, figs. 21 and 21 a, also II. p. 208.

The type came from Clanwilliam: other specimens were recorded by Purcell from Steinkopf in Namaqualand, and females apparently referable to this species from Van Wyk's Vlei and from Namies in Bushmanland.



Text fig. 5. *Solpuga ferox* Pocock. Shewing flagellum and terminal portion of left upper jaw viewed (a) from the mesial side, (b) from the dorsal side: specimen from Kimberley.

Solpuga alvicornis Kraepelin [Pl. VII, fig. 34], 1914. *Beit. z. Kennt. Land- u. Süsswasserfauna Deutsch-Südwestafrikas, Skorpiones u. Solifugae*, p. 125, fig. 2.

The type came from Keetmanshoop. It is also known to me from the neighbourhood of Kuruman (F. A. O. Pym) and Mt Temple (T. C. Lanham).

In the Kuruman specimens, the flagellum, and with it the terminal fang of the upper jaw, is twisted outwards away from the main axis of the jaw. The basal enlargement is high and swollen. There are long stridulatory ridges on the chelicerae. The upper surfaces of the chelicerae bear long stout bristles but no definite spines. The fang of the lower jaw is short, the distance from the tip to the apex of the first tooth being about $1\frac{1}{3}$ times as long as the distance between the apices of the two large teeth.

Solpuga collinita Purcell, 1903. *Annals S. Af. Mus.* III. p. 3, fig. 2.

The type came from Willowmore C. P.

Solpuga vineta C. L. Koch, 1842. Kraepelin, *Das Tierreich*, p. 63, fig. 23. Purcell, *Annals S. Af. Mus.* I. p. 420, fig. 23.

It is recorded by Dr Purcell only from the neighbourhood of Capetown.

Solpuga maraisi Hewitt [Pl. V, fig. 23], 1913. *Records Albany Mus.* II. p. 480, Text fig.

The type came from Caledon C. P. The species is also known from Worcester (G. B. Townshend), and Stellenbosch (C. S. Grobbelaar). On the outer side of the lower jaw, a keel is present near the apex of the fang, but more proximally the lateral crest is obsolete. The feather bristles of the upper and lower jaws are weakly developed. The fang of the lower jaw is not greatly elongated, the distance from the tip of the fang to the apex of the first tooth being about twice, or a little less than twice, the distance between the apices of the two large teeth. Stridulatory ridges are moderately well developed on the upper jaw:

Solpuga spectralis Purcell, 1899. *Annals S. Af. Mus.* I. p. 424, fig. 25.

The type specimen came from Klipfontein, Namaqualand division.

Solpuga lateralis C. L. Koch [Pl. V, fig. 24], 1842. Kraepelin, *Das Tierreich*, p. 61, fig. 19. Purcell, *Annals S. Af. Mus.* I. p. 425, fig. 26.

Dr Purcell records this species from Port Elizabeth. It is known to me from Dunbrody (Fr. Vogt), and from Bussacks near the Kareiga River mouth (Mr F. G. C. Graham).

In males of this species, the stridulatory ridges of the upper jaw are rather weakly developed, sometimes being nearly obsolete. The fang of the lower jaw is moderately elongated, the distance from its tip to the apex of the first tooth being equal to about $2\frac{1}{3}$ times the distance between the apices of the two large teeth. The fang of the upper jaw is without a keel on its mesial side, as occurs in *hostilis* and *derbiana*, but the keel is represented by a prominent sharply pointed tooth.



Text fig. 6. *Solpuga erythronotoides* sp. nov. Dentition and flagellum of male, viewed from the mesial side.

Solpuga erythronota Kraepelin, 1900. *Das Tierreich*, p. 64, fig. 24.

The type of the species is indefinitely located S. Africa.

Solpuga erythronotoides sp. nov. [Text fig. 6].

This species is founded on a single male example found at Victoria West by Mr B. Marais. It is very closely related to *S. erythronota* Kraepelin, but

seems to differ as follows: the flagellum is shorter and its anterior bend more forwardly situated: there is a distinct interval between the first and second teeth of the lower jaw.

Dentition. The terminal fang of the upper jaw is short: there are three distinct anterior teeth, the first being small and the second and third of moderate size: there follows a long toothless interval terminated by the fourth tooth which is small and the fifth which is large but not much larger than the third: in the double series, the outer row has four teeth but the inner one only three, of which the distal one is largest. On the inner side of the jaw dorsally, near to the terminal fang and just in front of the anterior bend of the flagellum, is a prominent sharp pointed tooth terminating an abbreviated keel or ridge. The lower jaw has three teeth, the distal one largest and longest and separated from the small intermediate tooth by a short interval. On its outer side, a sharp lateral keel is only present in the distal fourth, whence it is continued as a line of granules to the base of the jaw. The distance between the tip of the fang and the apex of the first tooth is equal to about $2\frac{1}{2}$ times the distance between the apices of the two large teeth.

Flagellum. The basal enlargement is well elevated and has a sharply keeled dorsal margin: anteriorly it is only a little produced, the anterior bend being situated above the third tooth: the recurrent portion is sub-cylindrical and slender, except at the anterior bend where it is strongly flattened from front to back though not quite so broad as the fang at this point: it passes in a light curve immediately above the basal enlargement, and, twisting slightly outwards, terminates in an acutely pointed apex a little posterior to the hind margin of the basal enlargement; the length of the flagellum occupying a post-laminar position being much less than the distance between the anterior bend and the hind margin of the lamina.

The stridulatory area of the chelicera is well developed.

Colour. Head-plate and appendages pale brown: tibia and more distal segments of fourth leg dark brown, and the distal segments of the other legs and of the palp are also more darkly coloured than the basal segments: abdominal tergites pale brown with some infuscation laterally, but there is no strongly contrasting pigmentation on the tergites: sides of abdomen clothed with long pale hairs: malleoli broadly margined with black.

Measurements. Total length 23, length of flagellum 1.7, of patella of palp, 5.4, of tarsus and tibia of palp 6.2, of patella of fourth leg 5.75, of tibia of fourth leg 5.2.

This species, and its near ally *erythronota*, are nearly related to *S. lateralis*.

Solpuga derbiana Pocock [Pl. II, fig. 4 and Text fig. 7], 1895. *Ann. Mag. Nat. Hist.* 6, xvi. p. 90, Pl. IV, fig. 8.

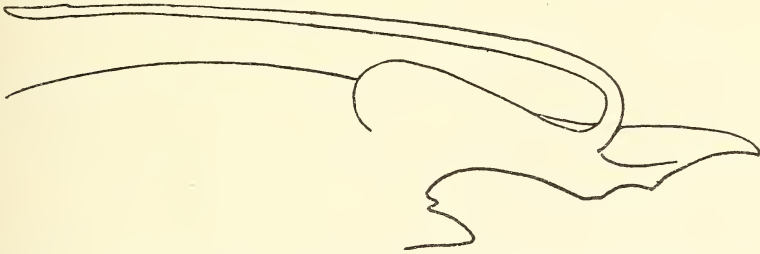
The type is labelled "Interior of S. Africa." Dr Purcell has identified therewith a species common at Grahamstown, and the information kindly supplied to me by Mr S. Hirst regarding the characters of the type specimen seems to confirm the identification. The species is known to me from Grahams-town, Brakkloof (Mrs G. White), Peddie and Line Drift near Peddie (B. Marais), Majuba Nek, Herschel dist. (J. Hepburn), and Damplaats near Burghersdorp (A. Kruger).

The length of the recurrent portion of the flagellum is greater than twice the distance from the anterior bend to the hind margin of the basal enlargement: and the tip of the flagellum reaches to a point situated very much

nearer to the hind dorsal margin of the chelicera than to the hind margin of the basal enlargement. The length of the flagellum will probably prove to be somewhat variable, but I have not yet seen material that can be regarded as intermediate between this species and *coquinae*, which is mainly distinguished therefrom by its shorter flagellum.

The basal enlargement of the flagellum is considerably elongated, and the anterior bend, which is not markedly broadened, lies immediately over the second tooth, or even very slightly anterior thereto. The shaft is subcylindrical almost throughout, but towards the tip there suddenly appears a dark brown sharp cutting edge dorsally: this is usually very slightly raised above the rounded surface of the main portion of the shaft, but to a variable extent, the cutting edge being more prominent in Peddie specimens than in examples from Grahamstown, and is scarcely visible in a specimen from Brakkloof near Grahamstown. The terminal fang of the lower jaw is not long, the distance from its tip to the apex of the first tooth being equal to about $1\frac{3}{5}$ – $1\frac{4}{5}$ times the distance between the apices of the two large teeth.

In the female the anterior tergites are reddish brown, becoming dark brown or nearly black near their lateral borders: in the sixth tergite the



Text fig. 7. *Solpuga derbiana* Pocock. Showing flagellum and terminal portion of left upper jaw viewed from mesial side: specimen from Peddie.

posterior border is also infuscated, and succeeding tergites are quite black. Sides of abdomen with pale hairs. Sternites dark brown at their lateral margins, but only very narrowly so anteriorly, and more broadly so in the posterior sternites. Hind legs red, chelicerae reddish, and head-plate with a red tinge. In the male the general colour is dull brown and the tergites are very dark, black behind and at the sides: mesial portions of six anterior tergites brown. Hind limbs brown, with well developed mane, the hairs thereof white with just a tinge of pale violet. Scopula of palp rufous. Sides of abdomen whitish.

A subadult male, lacking the flagellum, taken in Grahamstown (15. xii. 1918), greatly resembles the female in colour: it differs therefrom in the well developed mane of the hind leg, and the sides of the abdomen are whiter than in the female.

Measurements of adult male from Peddie and of adult female from Grahamstown: breadth of head-plate, M, 7.1, F, 8.6: length of patella of palp, M, 7.7, F, 6.7: of tibia and tarsus of palp, M, 7.8, F, 7.6: of patella of fourth leg, M, 6.9, F, 6.8: of tibia of fourth leg, M, 6.25, F, 6.1.

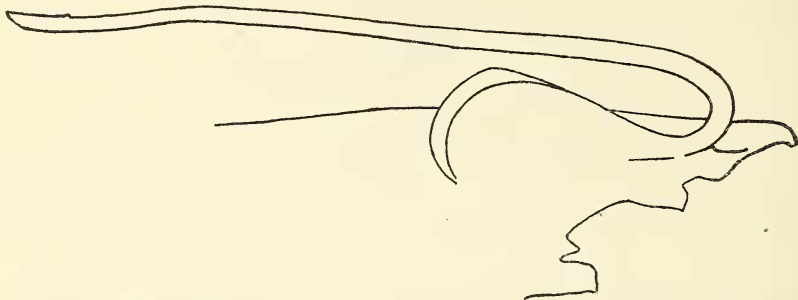
Solpuga tookei sp. nov. [Text fig. 8].

The type of this species is a single adult male from Mariannhill, Natal, kindly presented to the Albany Museum by the Curator of the Museum at the

Trappists Monastery near Pinetown. It is named after Lt. W. M. B. Tooke to whom the Albany Museum is indebted for the identification and arrangement of the collection of ticks belonging to that institution¹.

The species belongs to the group including *hostilis* White, and *marshalli* Poc., both of which have been recorded from the Durban neighbourhood (but the latter species quite erroneously, I think). In the Mariannhill specimen, the second tooth of the upper jaw is quite large, and the distance from the tip of the fang to the apex of this tooth is subequal to the distance between the apices of the second and fourth teeth: the gap between the second and third teeth is in fact not nearly so long as in *S. marshalli* Pocock or *S. hostilis* White, which latter species it more closely resembles in the characters of the flagellum.

Dentition. Upper jaw with a terminal fang of moderate length, and not upturned: first tooth small, second large, then follows a rather short and shallow gap, third tooth rather small, fourth the largest: in the double series, the outer row comprises three moderate sized teeth and one small one basally situated, whilst the inner row has the first and third teeth of moderate size



Text fig. 8. *Solpuga tookei* sp. nov. Portion of left upper jaw, with flagellum, viewed from mesial side.

but the second and fourth minute. In the lower jaw there is a strong prominent crest on the outer side, extending from apex to base. The two major teeth are both large and the middle one rather small: between the large distal tooth and the small middle one, there is a short but well-defined interval. The fang of the lower jaw is not long, the distance from the tip to the apex of the first tooth being about $1\frac{2}{3}$ times as long as the distance between the apices of the two large teeth. The stridulatory area on the inner surface of the upper jaw is ill developed, the ridges being short and weak, and the whole area decidedly smaller than usual: there are five ridges present and rudiments of two others.

Flagellum. The basal enlargement is moderately elongated; the anterior bend is in the same vertical as the first tooth; the shaft is narrow and sub-cylindrical, passing backwards just above the basal enlargement and extending to a point which is a trifle more remote from the hind margin of the basal enlargement than this is from the tip of the fang, thus not reaching so far as the hind margin of the chelicera. At the anterior bend the flagellum is not broadened, its width being less than half the extreme width of the fang at this point. Near the tip of the flagellum it presents dorsally a sharp cutting edge for a short distance.

¹ Since this was written, my friend William M. B. Tooke, 2nd Lieut. South African Infantry, fell in action at Fampoux, 12th April, 1917.

Palp with the tibia scopulate below except near the base, and only thinly scopulate near the apex.

Posterior legs carrying long hairs but they do not seem to form a definite mane.

Colour. Head-plate, mandibles, and appendages pale brown, the more distal segments of palps and legs dark brown, the infuscation being strongest on the distal segments from the patella onwards of the fourth leg. Abdominal tergites very dark, almost black superiorly throughout, but sides of abdomen clothed with pale yellow hairs. Malleoli not infuscated.

Measurements. Total length 20, length of flagellum 5·2, of patella of palp 5·25, of tarsus and tibia of palp 6, of patella of fourth leg 4·7, of tibia of fourth leg 4·55.

Solpuga coquinae Hewitt, 1914. *Records Albany Museum*, III. p. 9, fig. 2.

The type came from Cookhouse C.P. and we have other specimens from Somerset East (E. Driver), Longhope (E. Abrahamson) and a fairly distinct variety from Kimberley (J. H. Power) and Bloemfontein (Dr T. F. Dreyer).

The flagellum varies a little in length, being a trifle longer relatively in large specimens than in small ones, but the total length of the recurrent portion is never more than twice the distance from the anterior bend to the hind margin of the basal enlargement: the apex is considerably nearer to the hind margin of the basal enlargement than to the posterior dorsal margin of the chelicera. The flagellum is not markedly broadened at the anterior bend.

In specimens from Kimberley and Bloemfontein the flagellum differs only slightly from that of the type, in that the basal enlargement is a trifle deeper, more rounded, and less produced anteriorly, whilst the shaft is a little longer and straighter but sometimes bent downwards rather abruptly near the tip: these minor differences are exhibited more particularly in the single example from Bloemfontein.

It is possible, however, to distinguish this form from that of the type, owing to the greater length of the fang of the lower jaw. In the typical variety, the distance from the tip of the fang to the apex of the first tooth is about equal to $1\frac{1}{2}$ – $1\frac{2}{3}$ times the distance between the apices of the two large teeth: in the Kimberley and Bloemfontein specimens, the proportion is greater, being 2 – $2\frac{1}{2}$: 1. This form I now designate *S. coquinae* var. nov. *orangicus*.

The species is smaller than *S. hostilis* or *derbiana*: the measurements of an adult female from Cookhouse are as follows: breadth of head-plate 6·75, length of tibia and tarsus of palp 6·7, of patella of palp 5·6, of tibia of fourth leg 5·6, of patella of fourth leg 6.

The colouration is very much like that of *hostilis*. In the typical male all the abdominal tergites are infuscated throughout, and the sides of the abdomen silvery, but in the Kimberley and Bloemfontein specimens, one or two of the anterior tergites are dark brown not black. The hind legs are more or less infuscated, rather than red as in *hostilis*. In the female, on each side of the anterior tergites, which are brown, there is a more or less distinct dark stripe passing backwards into the blackened area posteriorly, and along the midline also is a series of dark stripes but these are in the soft skin between the tergites: the hind legs are red.

Solpuga hostilis White [Pl. IV, figs. 16 and 17, and VI, fig. 29], 1846. Pocock in *Ann. Mag. Nat. Hist.* 6, xvi. p. 89, Pl. IV, fig. 7. Purcell in *Annals S. Af. Mus.* 1. p. 427, fig. 27 (*cultrata*).

The species cannot be recognised from the original description and figure given in Methuen's *Life in the wilderness*, and the locality of the type was simply stated as "S. Africa, near the tropic of Capricorn." Mr Pocock, having examined the types, has specifically identified therewith some specimens from Estcourt; and a species recorded from Durban and described by Dr Purcell under the name of *S. cultrata* is now regarded by Purcell and Kraepelin as *hostilis*. This species is common in the Transvaal and has been recorded by me from various localities in the Pretoria and Zoutpansberg districts. We have a series of both sexes from Doornkop near Belfast (R. Gerhardt). An example from Lüneburg, Natal (W. Oom) differs from any of the above in that the tip of the upper fang is scarcely up-turned, and the flagellum is not bent downwards near the apex.

In the male, stridulatory ridges are usually quite absent from the chelicerae: in a specimen from Gezina, Pretoria, three abbreviated ridges occur. The fang of the lower jaw is long, the distance from its tip to the apex of the first tooth being equal to about $2\frac{1}{2}$ times the distance between the apices of the two large teeth. The keel on the outer side of the lower jaw of the male is very strongly developed, being much more pronounced than in *marshalli*. It varies however to some extent, but usually in the basal portion of the jaw is raised into quite a high ridge.

In the female the anterior tergites are uniformly reddish brown, the blackening of the posterior part of the abdomen commencing rather suddenly: in Transvaal specimens black pigmentation only occurs on the last three tergites. In specimens from Lüneburg the sides of the anterior tergites are infuscated, but this blackening does not take the form of sharply defined blotches or stripes such as occurs in *chelicornis*. Males have the tergites more or less infuscated throughout, the mesial portions of the anterior tergites being dark brown and the sides black: hind legs red in both sexes, maned only in the male. The measurements of an adult female from Pretoria are: breadth of head-plate 9.1, length of tibia and tarsus of palp 8, of patella of palp 7, of tibia of fourth leg 6.5, of patella of fourth leg 7.3.

A very young specimen from Mfongosi, Zululand, has only 5 joints on the fourth tarsus of one side, but is normal on the other side.

Solpuga marshalli Pocock [Pl. VI, fig. 30], 1895. *Ann. Mag. Nat. Hist.* 6, xvi. p. 91, Pl. IV, figs. 9 and 9a.

The type came from "Fort Salisbury, Mashonaland." The species is not easily recognised from Pocock's figures, whilst Kraepelin's illustration in *Das Tierreich* seems to me referable to some other species, and perhaps may not be based on Mashonaland material. Kraepelin records the species from the Transvaal and from Durban but these records may be viewed with some suspicion in view of possible confusion with *hostilis*, and seeing that no specimens of *marshalli* are represented in the Transvaal and Durban Museums. Mr Hirst informs me that in the type specimen the end of the flagellum is very finely pointed, and the edges near the end very finely granular.

We have male and female specimens from Salisbury (Fr. J. O'Neil, and C. von Hirschberg). In the male, as in the female, stridulatory lamellae are present on the chelicerae but are not long. Towards the tip of the flagellum its dorsal edge is minutely serrulated. The fang of the lower jaw is not very

long in the male, the distance from the tip of the fang to the apex of the first tooth being about equal to $1\frac{3}{4}$ times the distance between the apices of the two large teeth.

The measurements of male and female specimens are as follows: breadth of head-plate, M, 7.5, F, 9; length of tibia and tarsus of palp, M, 8.5, F, 7.9; length of patella of palp, M, 8.35, F, 6.65; length of tibia of fourth leg, M, 7.8, F, 6.3; length of patella of fourth leg, M, 8.4, F, 7.1.

This species is more darkly coloured than *hostilis*. The tergites are strongly infuscated in both sexes, but the mesial portions of the anterior segments are dark brown rather than black. The soft skin at the sides of the abdomen is somewhat infuscated, though silvery white hairs occur there. The sternites are broadly infuscated at the sides in both sexes, but more specially in the male. Hind legs very dark brown.

Solpuga jumodi Purcell, 1903. *Novitates Zoologicae*, vol. x. p. 304, fig. 2.

The type came from Shilowane, Zoutpansberg dist. and I have recorded it from Vygeboompoort in the Waterberg dist.

Solpuga tubicen Kraepelin [Pl. VII, fig. 35], 1911. *Mit. a. d. Nat. Mus. Hamburg*, xxviii. p. 102.

This is a Transvaal species, but no precise locality is known. There is a dense group of stout bristles on the upper surface of the chelicera, near to the basal enlargement, and to the end of the shaft. On the inner side of the upper fang there is a very strong outstanding keel, commencing at the anterior bend and extending forwards beyond the first tooth. No distinct mane on the hind legs. In the lower jaw, the distance from the tip of the fang to the apex of the first tooth is equal to about twice the distance between the apices of the two large teeth, or a trifle more than twice.

Solpuga hamata Hewitt, 1913. *Annals Transvaal Mus.* iv. p. 160, fig. 22.

The type came from Mamiaanshoek near Zwagershoek in the Waterberg dist., and other specimens were recorded from Vygeboompoort in the same district.

The fang of the lower jaw is very long, the distance from the tip to the apex of the first tooth being about three times the distance between the apices of the two large teeth, or even a little more.

Solpuga bechuanica Hewitt [Pl. IV, fig. 14], 1913. *Annals Transvaal Mus.* iv. p. 161, fig. 23.

The type came from Serowe in the Bechuanaland protectorate. Stridulatory ridges on the chelicerae are only weakly developed in the male. The large teeth of the lower jaw are widely separated, a distinct interval occurring between the distal tooth and the small intermediate tooth: the distance from the tip of the fang to the apex of the distal tooth is about $1\frac{3}{8}$ times the distance between the apices of the two large teeth.

As in *chelicornis* and *villosa*, this species has a row of four long spines on the outer side of tarsus II superiorly: in *hostilis* and *venator* distinct spines are wanting, being represented however by bristles several of which in *marshalli* are spiniform.

Solpuga chelicornis A. Licht. [Pl. III, fig. 11], 1796. Kraepelin, *Das Tierreich*, p. 59, fig. 17.

Of this species, several varieties markedly differing in colour may be recognised.

Mr S. C. Cronwright-Schreiner, in writing of the living animal as found at Hanover, described it as "of a most brilliant yellow, with a heavy black band down the back of the abdomen while the legs are covered with long yellow hair, which in the male, becomes a distinct mane and is iridescent. As it lies on the sand on a hot day, sparkling in the sunshine, it is a most exquisite creature¹."

This variety I now designate *S. chelicornis* var. *pubescens* [Pl. II, fig. 2]. Its most marked character is a dense pile of short pale hairs on the upper surfaces of the patella and tibia of the palp in the adult male, and to a less extent in the female. The sides of the head-plate and chelicerae are thickly, though rather shortly, bearded. The fringes of hair on the hind legs are particularly heavy, extending in attenuated form as far as the distal segments of the tarsi. The lateral black bands of the abdomen commence to merge on the fourth abdominal tergite, and fusion is quite complete on the fifth tergite. The terminal fang of the lower jaw is long, the distance from the tip of the fang to the apex of the first tooth being equal to about twice the distance between the apices of the two large teeth. In the single series of the upper jaw, the distance between the first and second teeth is about $1\frac{1}{2}$ times the distance between the second and fourth teeth. This variety is known to me from De Aar (S. C. Cronwright-Schreiner and Miss E. Friedlander), and presumably the Hanover specimens are referable thereto. We have female examples which seem to belong to the same variety from Dikkop Flats near Grahamstown (Miss J. Harris), and from Zandkraal near Steytleville (Miss A. Geard). Also, Dr Purcell's records from Namaqualand, Kenhardt, and Willowmore divisions are probably based on this variety.

According to Kraepelin's account in *Das Tierreich*, the typical form of the species is coloured quite differently, much as in the following form now named *S. chelicornis* var. *rufescens* [Pl. II, fig. 3]. This variety is known to me from Longhope (Miss E. Abrahamson), and Dirkskraal, Somerset East dist. (B. Marais). The upper surfaces of the patella and tibia of the palp are quite devoid of the pile of short hairs that occurs in *pubescens*. The sides of the head-plate and chelicerae are not bearded. All the hairs of the mane on the hind legs are white, at any rate in their distal portions, but the hairs situated on the broader part of the mane are magenta coloured in the basal half of each hair. The hairs on the sides of the abdomen are quite white. The surfaces generally are dull brown, more darkly so on the tibia and tarsus of the palp: the pale brown mesial area of the abdomen superiorly extends over the first seven tergites, being bordered on each side by a black stripe, and posteriorly by a black patch which covers the hind tergites.

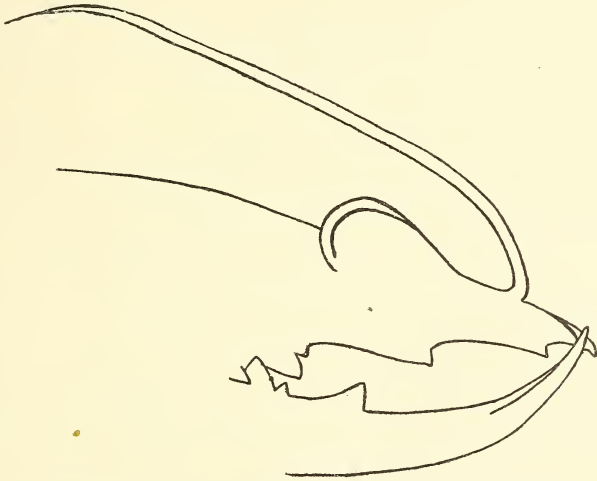
The jaw characters are similar to those of *pubescens*.

Another distinct variety occurs at Kakamas (Miss H. C. Olivier). It differs from the two just described principally in the spacing of the teeth of the single series of the upper jaw: the distance between the first and second teeth is less than the distance between the second and fourth teeth; in the lower jaw, the distance from the tip of the fang to the apex of the first tooth is about equal to $1\frac{4}{5}$ times the distance between the apices of the two large teeth. The appendages are pale yellowish (in spirits): the posterior tergites are not so deeply blackened as in *pubescens*, yet the infuscation extends considerably forwards, the mesial pale brown area only reaching backwards over the first four abdominal tergites. The mane of the hind legs is not so strongly developed

¹ "Some Arachnids at Hanover, Cape Colony," by S. C. Cronwright-Schreiner, in the *Popular Science Monthly*, December, 1902.

as in either of the varieties just described, nor is there a conspicuous pile of short hairs on the upper surfaces of the patella and tibia of the palp, although numerous very short hairs occur there. This form I now designate *S. chelicornis* var. nov. *macrognathus* [Text fig. 9]. The colouration approaches that of the *hostilis* section, and the dentition is not very different from that of *S. bechuanica*.

Lastly, Kraepelin has recorded *chelicornis* on the evidence of a female specimen from Okawango in the north of S.W. Africa. It may also be noted that Kraepelin's figure in *Das Tierreich* seems to indicate a variety distinct from any of the above in respect to the dentition.



Text fig. 9. *Solpuga chelicornis macrognathus* var. nov. Left chelicera of male viewed from mesial side.

The measurements of the adult males of the three forms here distinguished are as follows:

	var. <i>rufescens</i>	var. <i>pubescens</i>	var. <i>macrognathus</i>
Breadth of head-plate ...	6.1	8	5.8
Length of patella of palp ...	8.2	10.8	8.3
Length of tibia and tarsus of palp	8.8	11.1	(absent)
Length of patella of fourth leg ...	8.3	11.1	8.5
Length of tibia of fourth leg ...	8.4	11.3	8.15

Solpuga villosa Purcell, 1899. *Annals S. Af. Mus.* I, p. 422, fig. 24.

The type male of this species was indefinitely located "S. Africa." Other specimens which seemed to be referable thereto were recorded from Concordia in Namaqualand, and from Fraserburg: these, however, were apparently female examples, and as such possibly indistinguishable from *chelicornis*. Subsequently, Dr Purcell regarded this species as essentially the same as *chelicornis*, and Prof. Kraepelin also held the two as conspecific, though distinct as varieties. To me, it seems well worthy of distinction from *chelicornis*. We have male specimens agreeing precisely with the description of *villosa*, from Victoria West (P. D. Morris), and from Tafelberg (Miss A. Gadd). Females from these localities are easily distinguishable from those taken along with the *pubescens* form of *chelicornis* in the colour pattern of the

abdomen: in *villosa*, there are only three pairs of black blotches on the abdomen anteriorly, these being followed immediately by the black patch which covers all the posterior tergites: in *chelicornis* var. *pubescens* there are six or seven pairs of black blotches in front of the continuous bands. In both species, the posterior abdominal sternites are infuscated throughout their breadth, instead of at the sides only, as in females of *hostilis* or *derbiana*: the blackening is more intense at the sides however. The hind borders of the genital plates are considerably produced in both species.

The terminal fang of the lower jaw is not quite so elongated as in the *pubescens* form of *chelicornis*, which this species resembles in the possession of a dense pile of short hairs on the upper surfaces of the distal segments of the palp in both sexes, but more especially in males: the distance from the tip of the fang to the apex of the first tooth is about equal to $1\frac{4}{5}$ times the distance between the apices of the two large teeth.

Solpuga hastata Kraepelin, 1899. *Das Tierreich*, p. 58, figs. 15 and 16.

The type and only known specimen is indefinitely located Gt. Namaland.

Solpuga methueni Hewitt, 1913. *Annals Transvaal Mus.* vol. iv. p. 153, fig. 18.

The type came from Quibis, S.W.A., near the Karasbergen.

Solpuga ornithorhyncha Hewitt [Pl. V, fig. 19], 1913. *Annals Transvaal Mus.* vol. iv. p. 151, fig. 17.

The types came from localities near the Karasbergen, S.W.A., viz. Kraikluft, Narudas Süd, and from between Kraikluft and Sandmund. Stridulatory ridges are well developed on the chelicerae of the male. The lower jaw has numerous feathered bristles on its inner side, and on the outer side is a feeble but distinct ridge distally. The colouration of the abdomen has a general resemblance to that of *hostilis*, and the species is no doubt diurnal in habit. The tergites are entirely brown except for slight infuscation in the middle, which is faint in the anterior segments but more pronounced posteriorly, the three posterior tergites being dark brown throughout: the soft skin between the tergites is also blackened mesially. On each side of the tergites, the soft skin is blackened as a continuous longitudinal stripe. Below this, the sides are silvery. The sternites are infuscated laterally.

Solpuga lineata C. L. Koch [Pls. III, fig. 7, and VI, fig. 33], 1842. Kraepelin, *Das Tierreich*, p. 65, fig. 26. Purcell, *Annals S. Af. Mus.* 1. p. 428, fig. 28.

Dr Purcell records this species from the divisions of Namaqualand, Carnarvon, Uitenhage, Robertson and Swellendam. It is known to me from Alicedale (F. Cruden), Dunbrody (V. Powels), De Aar (Miss E. Friedlander) and Victoria West (B. Marais).

Stridulatory ridges are well developed on the chelicerae of the male. In the lower jaw of the male, the patch of bristles on the inner surface includes two or three curved spines distally, thus differing from *hostilis*, and most other species, where the patch is composed of bristles of more uniform size: the stouter curved bristles and spines are mostly in a single line along the lower portion of the extensive patch of bristles. There are numerous feather bristles which, however, like those of the upper jaw, are not very densely feathered. There is a very long interval between the first and second teeth of the lower jaw. On the outer side of the lower jaw is a distinct keel. In the female the posterior margins of the genital sternite are rounded.

Species incertae sedis.

Solpuga brevipalpis Purcell, 1899. *Annals S. Af. Mus.* I. p. 431, fig. 29.

The types are female specimens from Naroep in Gt Bushmanland. It is an ally of *S. lineata*.

Solpuga caffra Pocock, 1897. *Ann. Mag. Nat. Hist.* 6, xx. p. 262.

The types, two adult females, came from Estcourt. The colour characters are like those of *S. toppini* Hirst, from Ngxwala Hill, Zululand.

Solpuga nigrescens Pocock, 1895. *Ann. Mag. Nat. Hist.* 6, xvi. p. 88.

The type is a female example labelled "Lower Zambesi." Mr Pocock doubtfully identified therewith some specimens from the north-eastern region of Victoria Nyanza.

Solpuga schultzei Kraepelin, 1908. *Denks. d. med.-nat. Gesell. Jena*, XIII. p. 270, figs. 2 and 3.

This species is based on a female example collected at Rooibank near Walfish Bay. It is closely related to *picta*—which according to Kraepelin includes *nigrobaccata*—the two species being remarkable in the great elongation of the jaws, the first tooth of the upper jaw being considerably removed from the second as well as from the apex of the jaw. Apparently also, the tibia of the second leg has thickened hairs instead of spines on the dorsal side externally.

Solpuga striata Kraepelin, 1914. *Beit. z. Kennt. Land- u. Süßwasserfauna Deutsch-Südwestafrikas, Skorpiones u. Solifugae*, p. 124, fig. 1.

The type specimen, taken on farm Voigtsland about 38 km. east of Windhuk, is probably very immature, being only 11 mm. long (without mandibles). Kraepelin seemed to regard it as referable to the group of *S. lateralis* and allies, but I have no doubt that it really belongs to the group of species including *S. sericea* Poc., *S. zebrina* Poc. and *S. celeripes* Hirst, and quite possibly is identical with one of these. The colour pattern represented in Kraepelin's illustration is precisely similar to that exhibited by male and immature specimens of *celeripes*.

Solpuga picta Kraepelin, 1899. *Das Tierreich*, p. 81, figs. 59 and 60. Purcell, *Annals S. Af. Mus.* I. p. 431, fig. 30 (*S. nigrobaccata*).

The species is merely located as Damaraland.

Solpuga scopulata Karsch, 1880. Kraepelin, *Das Tierreich*, p. 60.

This species is only known from a female specimen taken at Hantam C.P.: it seems to be very like *chelicornis* Licht.

Key to the South African species of the genus Solpuga Licht. mainly based on the characters of adult males.

Group I.

Dentition of upper jaw almost alike in the two sexes, the distal series composed of four or five teeth in a continuous row, not broken by long toothless intervals, the first and second teeth being relatively large. The

terminal fang of the lower jaw not keeled on the outer side, or only weakly so, and not greatly elongated in the adult male, the distance from the tip of the fang to the apex of the first tooth being usually $1\frac{1}{2}$ times, or less, or at any rate not greater than $1\frac{3}{8}$ times the distance between the apices of the two large teeth: mesial surface of both upper and lower jaw usually with fairly strong development of feather bristles. In the male, the tibia of the palp is scopulate inferiorly over some portion of its length: upper margin of basal enlargement of flagellum blunt or sharp, but not greatly compressed into a thin high keel (except perhaps in *darlingi*): no keel on the mesial surface of the fang just in front of the anterior bend of the flagellum. Posterior median angles of the two halves of the first abdominal sternite in the adult female either rounded or rectangular, never produced into narrow lobes. Posterior legs usually with sparsely disposed long hairs (occasionally as in *sericea* with numerous very long ones), never forming a distinct mane in either sex. (Species mostly nocturnal in habit and plainly coloured, being uniformly yellow or brown: only occasionally striped with black, or with strongly contrasting colours on the abdomen.)

A. Flagellum slightly produced anteriorly, the anterior bend situated fairly far forwards, over the first or second tooth: shaft long and subcylindrical over the greater portion of its length and with a projecting tooth near to the apex, or distinctly bifurcated distally.

1. Flagellum very long, reaching backwards as far as the ocular tubercle or a little further, strongly sinuate not far from the apex and just proximal to its lateral tooth which is short and sharp: the shaft of the flagellum is low lying, being only just above the basal enlargement anteriorly.

S. lethalis typicus Koch.

2. Similar thereto, but shaft of flagellum straight, not sinuate, the shorter apical branch ending bluntly and its surface minutely serrulated.

S. lethalis rectus var. nov.

3. Flagellum reaching backwards beyond the middle of the mandible but terminating some distance in front of the eye tubercle, only lightly sinuate between the apex and the short sharp lateral tooth; the apex laterally compressed and dilated above into a knife-like edge: anteriorly, the recurrent portion almost touches the basal enlargement.

S. venosa Purcell.

4. Flagellum reaching backwards beyond the middle of the mandible but not reaching the head-plate, terminating in a short sharp subulate apex at the base of which a fine straight pallid bristle-like process springs from the upper edge and extends backwards beyond the apex: proximally the shaft lies close to the basal enlargement, which is well elevated: anterior bend of flagellum situated behind the level of the first tooth and nearly over the second. Lower jaw with two or three small intermediate teeth. Dorsal surfaces of body, head-plate, and appendages strongly infuscated throughout in both sexes.

S. fusca C. L. Koch.

5. Similar to *fusca*, but the spine-like process near the apex of the flagellum much shorter, not extending as far as the apex: anterior bend of flagellum situated almost immediately over the first tooth. Lower jaw with only one intermediate tooth. Dorsal surfaces somewhat infuscated. *S. toppini* Hirst.

6. Flagellum not quite reaching the head-plate: towards the apex it presents a distinct bend and then bifurcates into two sickle-shaped processes, each finely pointed at the tip, the mesial and more slender process carrying microscopic setose teeth on its surface.
S. furcifera Kraep.

B. Recurrent portion of flagellum long, usually reaching as far as the ocular tubercle or beyond, but not toothed nor bifurcate at the apex, nor serrated along its upper edge (or only faintly serrated immediately anterior to the distal sinus in *venator*). The shaft is broadest at the anterior bend but is not strongly flattened there.

7. Flagellum strongly sinuate near to the apex, proximally lying close above the basal enlargement which is comparatively short and its upper edge arched: the anterior bend lies over the apex of the first tooth or a little anterior thereto. Only one small tooth between the second and third large ones of the upper jaw, or if two are present one of them is quite minute.
S. venator Poc.

8. Flagellum reaching back well beyond the ocular tubercle, straight throughout, or slightly sinuate towards the apex, the proximal portion situated well above the basal enlargement which is very long and low, the upper edge thereof being straight for quite a long distance. Usually two rather small teeth between the second and third large ones of the upper jaw, but the first of these may be quite minute or practically absent. A very strong development of long and straight stout spines on the outer and upper surfaces of the upper jaw.
S. monteiroi Poc.

C. Procurrent portion of flagellum short: shaft long and more or less cylindrical, at any rate over the first half of its length, sometimes a little flattened, finely serrated for some distance along the upper or lower edge distally or along a curved or spiral ridge (in *spiralicornis* the serrated edge may be very short or perhaps obsolete).

9. Terminal fang of upper jaw very short, with fairly strong blunt internal tooth dorsally against which the lower jaw closes: shaft of flagellum somewhat flattened, more especially at the anterior bend which is rather broad, reaching back a little beyond the middle of the mandible, lightly arched in the distal third and gradually tapering to a fine point. Anterior bend of flagellum over the first tooth, or the interval between the second and first teeth. A fairly strong development of long pointed spines on upper surface of chelicera.
S. schlechteri Purcell.

Terminal fang of upper jaw quite long, with a minute internal tooth.

10. Flagellum reaching to a point between the middle of the mandible and the ocular tubercle, bearing a more or less distinct denticulate crest in the posterior third or fourth of its length: there are usually two light curves in its course, a long one proximally and a short one distally (but these are sometimes obsolete), and between them is a shallow dorsal sinus situated in the distal third. Viewed from above, the distal portion of the flagellum beyond the sinus is practically in a line with the main axis, and the shaft is not abruptly narrowed at the sinus, but tapers gradually from this region to the apex. Anterior bend of flagellum situated over the second tooth. Basal

enlargement high, not much elongated, the anterior upper margin being rather lightly curved, but not forming an angle with the posterior ridge which is strongly curved.
S. serraticornis Purcell.

11. Similar thereto, but flagellum reaching as far as the ocular tubercle. A dense group of long strong spines on the upper and outer surfaces of the chelicerae.
S. serraticornis var. *umtatica* Hewitt.

12. Flagellum reaching just beyond the middle of the mandible, spirally twisted, and carrying a spiral serrated crest over the distal two-thirds of its length except near to the tip. Basal enlargement short, with curved upper margin. On the upper surface of the chelicerae there are a few long slender spines and stiff bristles but practically no stout spines.
S. strepsiceros Kraepelin.

13. Somewhat like *serraticornis*, but the denticulate crest on the flagellum feebly developed, being restricted to the inferior edge at the distal sinus. The flagellum is twisted as well as curved at the well-marked distal sinus: viewed from above, the portion beyond the sinus is quite straight, or nearly so, and parallel with the main portion of the shaft but distinctly external thereto: at the distal end of the sinus, the shaft becomes rather suddenly reduced in thickness, and thence to the apex is gradually drawn out to a fine point. Basal enlargement somewhat elongated, the upper margin being straight or nearly so for a considerable distance: shaft rather broad at the anterior bend, but otherwise not flattened. On the lateral and upper parts of the chelicerae there is a very strong development of straight stout spines.
S. spiralicornis Purcell.

D. Recurrent portion of flagellum very short, not or scarcely extending back beyond the basal enlargement, and not strongly flattened over the greater portion of its length: procurrent portion very short, the anterior bend situated over the second tooth, or the interval between the first and second: on the inner dorsal edge of the upper jaw, just in front of the anterior bend of the flagellum, there is a small or minute tooth.

14. Flagellum an upstanding process, shaped somewhat like the horn of a rhinoceros, broad and strongly flattened from front to back at the anterior bend, tapering gradually towards the apex which is truncate, the central core projecting out therefrom a little: tip of flagellum situated just above the middle point of the basal enlargement.
S. schönlandi Pocock.

15. Flagellum somewhat similar, but at the apex is an enlarged globose swelling, the cuticle of which is minutely pubescent, thin, and pale, thus markedly contrasting with the shaft: the shaft is continued on the inner side of the swelling into a sharp-pointed flanking spine: the shaft is short and stout, being very broad at the anterior bend where it is flattened from front to back. Long spines and stout bristles are fairly well developed on the upper surface of chelicerae.
S. globicornis Kraep.

E. Flagellum not, or only slightly, produced anteriorly, the anterior bend overlying the second tooth; recurrent portion short, strongly flattened over the greater portion of its length: upper jaw on its inner dorsal edge, near to the anterior bend of the flagellum, furnished with a fairly conspicuous tooth, or two small teeth, against which the lower fang closes.

16. Shaft of flagellum extending backwards about as far as the basal enlargement: at the anterior bend it presents the appearance of a broad stiff membrane: this quickly becomes much broader, but at the same time is strongly folded longitudinally along the middle, so that a transverse section of the flagellum at about the middle point of its length would be V-shaped, the angle being directed upwards and forming the upper margin of the flagellum in side view. In the apical third, the membrane tapers gradually, the apex being not very sharp, and at a short distance therefrom on the inner side is a strong accessory tooth. The single dorsal tooth on the inner side of the fang projects forwards and is long and strong.
S. ferox Pocock.

17. Shaft of flagellum reaching back to a point which is a little further from the hind margin of the basal enlargement than this from the anterior bend. Tip of flagellum pointed and barbed somewhat like an arrowhead: the terminal portion is also armed at the base with two strong serrate teeth, one external and the other inferior.
S. sagittaria Pocock.

18. Tip of flagellum nearer to the posterior margin of the basal enlargement than is that margin to the anterior bend. Apex blunt. At the anterior bend, the shaft is very broad, becoming strongly twisted as it passes backwards: not far from the apex, its upper edge presents a small sharp tooth. On the inner dorsal edge of the fang of the upper jaw, there are two small tubercles near to the anterior bend of the flagellum.
S. suffusca Hewitt.

F. Like D, but flagellum a little longer and the anterior bend situated further back over the intermediate small teeth.

19. Recurrent portion of flagellum reaching back a little beyond the posterior border of the basal enlargement, and becoming gradually attenuated at the tip: basal enlargement with a high crest and upright posterior border.
S. darlingi Poc.

20. Recurrent portion a little longer than in *darlingi*, running backwards and upwards at an angle of 45° , straight throughout the greater portion of its length but distinctly sinuate in the distal fourth, the apex being directed upwards: basal lamina not so elevated, its outline about semicircular. Head-plate, mandibles and abdomen with black stripes.
S. sericea Poc.

21. Flagellum still longer, gradually tapering to a slender apex, which is situated about midway between the anterior bend and the ocular tubercle; shaft doubly sinuate from side to side and strongly curved in a vertical plane in its distal half, the apex being directed downwards. Basal enlargement high and almost circular in outline.
S. alstoni Purcell.

22. Shaft of flagellum strongly flattened over the first portion of its length, then becoming abruptly narrowed distally so that the apical third or fourth is setiform: total length of recurrent portion equal to about twice the distance between the anterior bend and the hind margin of the basal enlargement, which is rounded in outline. First tooth of lower jaw situated midway between the second tooth and the tip of the fang: lower jaw with feathered bristles on its inner surface. Upper jaw with no distinct tooth on the superior inner margin near the base of the fang. Dorsal surfaces with blackish stripes.
S. celeripes Hirst.

G. Shaft of flagellum short, directed forwards and extending about as far as the tip of the fang or even a little anterior thereto,

then curving upwards a little but not or only slightly recurved, broad and strongly flattened throughout, distally with several short lobes or processes. In the upper jaw, the single series includes two anterior strong teeth, followed by a short interval, and then two or three teeth.

23. Flagellum terminating in a short sharp strongly curved spur, directed outwards and upwards, and composed of two closely appressed pieces: on the outer edge of the shaft, near to the apex, is an obtuse lobe-like process, and on the inner edge, still nearer to the apex, is a curved filiform process minutely serrulated along its outer edge. *S. cervina* Purcell.

24. Similar thereto, but flagellum terminating in a broadly ovate lobe, with rounded apex, and provided with a straight acute process extending outwards from the posterior upper part: the upper edges of the lobe and its process are continuously serrated. *S. collinita* Parcell.

25. Shaft of flagellum broadening out distally and dividing into three divergent backwardly directed slender processes, the middle one of which is shortest and stoutest, being straight, indurated and sharply pointed at the tip, the other two being curved and comparatively weak, the shorter mesial one being finely serrulate above near its apex. *S. alvicornis* Kraepelin.

Group II.

Dentition of the upper jaw very dissimilar in the two sexes; in the female continuous, and closely resembling that of Group I; but in the adult male with a long toothless space in the middle of the single series (except in *Junodi*), thus separating the teeth into two groups of two teeth each, the teeth of the distal group varying much in size and occasionally with an additional small tooth anteriorly. Adult female with the first abdominal sternite more or less produced at the hind angles mesially into a pair of narrowed lobes (cp. Pl. III, fig. 11).

The species are all diurnal, and at once distinguished from the nocturnal species of group I by the strongly contrasting colours of the abdomen, the sides of which are white or yellow, whilst the posterior tergites are black or strongly infuscated, the anterior tergites being paler mesially but usually becoming infuscated laterally, thus presenting a dark lateral band on each side which gradually merges with the blackened area of the posterior tergites. The upper margin of the basal enlargement of the flagellum of the male is elevated into a sharp keel: the lower jaw usually has a very long fang, and on the outer side distally is a sharp keel, which is sometimes continued as a prominent granular crest towards the base of the jaw: feather bristles are poorly developed on the inner surface of the lower jaw, and are not very well developed on the upper jaw. Posterior legs usually with numerous long hairs which are sometimes arranged in a distinct mane in adult males.

A. Terminal fang of upper jaw without a long keel on its mesial side, but provided with a dorsal forwardly projecting tooth just in front of the anterior bend of the flagellum, or with an abbreviated

keel. Flagellum strongly flattened from front to back at the anterior bend, being as wide as the fang itself at this point, or nearly so. Shaft of flagellum filiform throughout.

26. Flagellum reaching back a little beyond the ocular tubercle and slightly blunted at the tip: the anterior bend situated far forwards, overlying the most distal tooth: basal enlargement very high, the whole upper margin elevated as a high laminar keel. On the inner side of the upper jaw, near to the anterior bend, is a distinct dorsal tooth pointing forwards. Two distal teeth of upper jaw moderately large, and in front of these is a more or less distinct though minute additional tooth.

S. lateralis Koch.

27. Anterior bend of flagellum overlying the tooth preceding the long interval, the shaft terminating a little posterior to the hind margin of the basal enlargement. Three distal teeth in the upper jaw, the second and third being of moderate size.

S. erythronotoides sp. nov.

28. Anterior bend more posteriorly situated, overlying the toothless interval: shaft reaching back about half way along the mandible. Basal enlargement high. Two distal teeth of upper jaw moderately well developed.

S. erythronota Kraepelin.

B. Shaft of flagellum not simply filiform, but more or less flattened and expanded in the distal portion, where the edges are frayed out into processes or deeply serrated.

29. Terminal fang of upper jaw with a dorsal tooth but no keel or only a very weak one on its mesial side. Flagellum broad at the anterior bend, which overlies the tooth preceding the long interval, reaching back about as far as the ocular tubercle, and filiform over the greater portion of its length, but in the terminal third it expands slightly into a lamina and divides into two main portions, the longer one being drawn out to a filament with serrated margins, the shorter one ending abruptly but bearing a short and slender serrated extension running parallel to the longer process just mentioned. Two distal teeth of upper jaw moderately large.

S. maraisi Hewitt.

30. Anterior bend of flagellum overlying the toothless interval, the shaft reaching back beyond the middle of the mandible, being deeply and finely serrated along its upper edge in the distal half which is much flattened from the sides. Fang of upper jaw with an exceptionally high keel arising from the upper surface along its inner edge, just above the distal group of teeth and in front of the flagellum.

S. spectralis Purcell.

31. Anterior bend situated as in *spectralis*, the shaft short, about as long as the terminal fang of the lower jaw, and serrated along three edges in its distal half which is expanded except towards the apex. A thin upright blade-like keel, serrated anteriorly, and provided with a sharp forwardly directed tooth about the middle of its length, occurs on the inner side of the fang of the upper jaw.

S. vincia Koch.

C. Terminal fang of upper jaw grooved on its mesial side superiorly for the reception of the procurrent portion of the shaft of the flagellum, the groove continued in front of the anterior bend, being bounded mesially by a long keel which extends from the anterior bend towards the tip of the fang. Flagellum not broad at the anterior bend, the shaft filiform, not expanded.

a. Anterior bend of flagellum posteriorly situated, overlying some portion of the toothless interval.

32. The distance from the tip of the flagellum to the hind margin of the basal enlargement is less than the length of the basal enlargement, which is much longer than high. Two distal teeth of upper jaw weak. In the lower jaw, the distance from the tip of the fang to the apex of the first tooth is about equal to $1\frac{1}{2}$ – $1\frac{2}{3}$ times the distance between the apices of the two large teeth.

S. coquinae typicus Hewitt.

33. Similar thereto, but fang of lower jaw longer, the distance from the tip of the fang to the apex of the first tooth being equal to about 2 – $2\frac{1}{2}$ times the distance between the apices of the two large teeth.

S. coquinae orangicus var. nov.

34. Flagellum short, reaching back only a little beyond the hind border of the basal enlargement, and suddenly expanded at its apex into a slender funnel with obliquely truncated margins. Two distal teeth of upper jaw of moderate size, the keel on the inner side of the fang strong and outstanding.

S. tubicen Kraep.

b. Anterior bend of flagellum more anteriorly situated, overlying the tooth preceding the long interval, or a trifle anterior thereto.

35. Flagellum reaching back nearly to the end of the mandible: basal enlargement much longer than high: two distal teeth of upper jaw weak.

S. derbiana Pocock.

36. Recurrent portion of flagellum short, ending in a fine point just posterior to the basal enlargement which has a high dorsal keel. The toothless interval of the upper jaw is practically obsolete as such, the two distal teeth being large, strongly compressed and sublunate. The teeth of the lower jaw are close together near the base, the fang being very long.

S. jumodi Purcell.

c. Anterior bend of flagellum still more anteriorly situated, overlying either the most distal tooth or even in front thereof.

37. Flagellum slender, reaching to the ocular tubercle, sharp-edged near the apex. Two distal teeth of upper jaw usually weak, but the second may be of moderate size. Viewed from the side, the terminal fang of the upper jaw is directed obliquely upwards to a slight extent, being at an obtuse angle with the main axis of the jaw.

S. hostilis White.

38. Flagellum terminating in a slightly upcurled point above the ocular tubercle, the apex being very finely pointed but not cultrate. The shaft is distinctly flattened over a considerable portion of its length. Viewed from the side, the short terminal fang of the upper jaw is directed horizontally forwards in a line with the rest of the jaw, which is itself greatly produced in the region of the extended toothless interval. Two distal teeth of upper jaw of moderate size.

S. marshalli Pocock.

39. Flagellum not reaching so far as the hind margin of the chelicera, its apex presenting a sharp cutting edge for a short distance dorsally. Toothless interval comparatively short, the distance from the apex of the second tooth to the tip of the fang, being subequal to the distance between the apices of the second and fourth teeth.

S. tookei sp. nov.

40. Flagellum reaching to a point slightly posterior to the ocular tubercle, the distal fifth being bent strongly downwards, the apex minutely forked, and the indurated outer upper edge of the bent portion is notched at a short

distance from the apex. Two distal teeth of upper jaw large, the apex of the second tooth being just a trifle nearer to the apex of the fourth than to the tip of the fang, or midway between the two. *S. bechuanica* Hewitt.

41. Flagellum reaching to the ocular tubercle, lightly sinuate in its distal fifth, flattened from above near the apex and notched on the inner edge. First tooth of upper jaw rudimentary, separated by an interval from the second, which is large and posteriorly situated, so much so that the distance from the apex of this tooth to the tip of the fang is much greater than the distance between the apices of the second and fourth teeth. *S. hamata* Hewitt.

Group III.

Related to II C, but upper jaw with two rather long toothless spaces in the single series of teeth. A very well developed mane present on the hind legs. Tarsus II with a row of four distinct spines on the outer side superiorly.

42. Flagellum with the anterior bend about in a line with the mid-point of the first toothless space, the recurrent portion more or less straight throughout, about reaching to the hind edge of the chelicera, the posterior margin of the basal enlargement being decidedly anterior to the mid-point of the length of the flagellum. *S. chelicornis* Licht.

a. A dense pile of short pale hairs on the upper surfaces of the patella and tibia of the palp in the male. In the upper jaw, the distance between the first and second teeth is decidedly greater than the distance between the second and fourth. *S. chelicornis pubescens* var. nov.

b. Similar thereto, but without a pile of short pale hairs on the upper surfaces of the palp. *S. chelicornis rufescens* var. nov.

c. In the upper jaw, the distance between the first and second teeth is less than the distance between the second and fourth. *S. chelicornis macrognathus* var. nov.

43. Flagellum reaching back to a point about midway between the ocular tubercle and the hind margin of the basal enlargement, which is about in a vertical line with the mid-point of the flagellum; the anterior bend is rather more posteriorly situated, and above it the shaft makes a bold high curve (not depressed as in *chelicornis*). *S. villosa* Purcell.

Group IV.

The single series of teeth in the upper jaw presents no long toothless intervals, and comprises six teeth (or only five when the normally minute fourth tooth is obsolete or lacking), of which only the one basally situated is of large size, the first tooth being small, the third also small, and the second still smaller. In the lower jaw, the apex of the first tooth is nearer to the tip of the fang than to the apex of the basal large tooth. Anterior bend of flagellum far forwards, in front of the first tooth, the procurant portion of the shaft not sunk into a groove of the upper jaw, so that there is no keel nor tooth on the mesial surface of the terminal fang. Tibia of

palp well scopulate inferiorly, the whole palp being subequal to or only very slightly shorter than leg III. Females also have six teeth in the single series of the upper jaw, the first, third and sixth being of large size.

44. Flagellum reaching back almost to the ocular tubercle, in its distal fourth flattened dorso-ventrally and ending in a flat lance-like apex.

S. hastata Kraepelin.

45. Similar thereto, but the terminal fourth of the flagellum is deeply grooved above and for a short distance keeled below.

S. ornithorhyncha Hewitt.

46. Flagellum much shorter, presenting a large bold curve at the anterior bend, and directed obliquely upwards in a sinuous line with two curves in its course, a short deeper one near the apex, and a longer shallower one proximally: it reaches backwards only a little beyond the hind margin of the basal lamina, which is remarkable in being produced upwards as a short outstanding process.

S. methueni Hewitt.

Group V.

Dentition of upper jaw similar in the two sexes, the single series comprising a distal tooth at some distance from the tip of the fang, followed by 1-3 small teeth and one large one, then 3-5 small teeth, and finally another large one. Terminal fang of upper jaw with a fairly long high ridge on its mesial side, starting near the anterior bend of the flagellum and proceeding towards the tip of the fang. Terminal fang of lower jaw short, the distance from the tip thereof to the apex of the first tooth being only about $1\frac{1}{4}$ times as long as the distance between the apices of the two teeth. Tibia of palp not scopulate below, the whole palp being decidedly shorter than leg III.

47. Flagellum reaching back a little behind the middle of the mandible, flattened out in its distal half which is slightly twisted and fringed along the edges: anterior bend about on a level with the second tooth. Upper surfaces with black stripes.

S. lineata Koch.

Genus *Zeriassa* Pocock.

Zeriassa cuneicornis Purcell, 1899. *Annals S. Af. Mus.* i. p. 413, figs. 20 and 20 a.

The type, described under the name of *Solpuga cuneicornis*, came from Southern Rhodesia.

Zeriassa purcelli Hewitt [Pl. VII, fig. 36], 1914. *Annals Transvaal Mus.* iv. p. 163, fig. 25.

This species is only known from Newington, N.E. Transvaal.

The female referred to in the original description does not belong to the species. A small example from Newington, with the two long preocular spines characteristic of the genus, is no doubt the true female of this species. In this specimen, the terminal fang of the upper jaw is comparatively long, the first tooth is small, the second tooth is very long and large, being the longest in the whole dental series, the third is small, fourth of moderate size, and the fifth large: this may be regarded as completing the single series, although the outer

row of the double series is quite continuous with the single series. The outer row includes four teeth of which the distal one is the largest, but is not so large as the adjoining fifth tooth of the single series. The inner row includes three teeth, of which the first is largest and is widely separated from the second as well as from the single series: the basal tooth is quite small. In the lower jaw there is only one intermediate tooth. Both upper and lower jaw are strongly compressed from side to side: the lateral distal keel on the outer side of the lower jaw thus becomes carried ventralwards, and is not continued into the granular crest which runs along the middle of the basal portion of the jaw. The lower jaw has great depth, and thus in side view has a massive appearance. Stridulatory ridges are well developed on the chelicerae, numbering about 12 in the male, and 9-10 in the female. Feather bristles are not well developed on the lower jaw of the male: it resembles that of the female but is not so strong. The flagellum of the male has various points in common with that of *cuneicornis*, and it may be noted that the upper margin of the basal enlargement is elongated in both, and that the upper and posterior margins are acutely inclined to each other, with a large high keel at the angle. The procurrent portion of the shaft lies on the upper surface of the jaw, and is not sunk into a groove: on the mesial side of the fang superiorly, just in front of the anterior bend, an ill defined ridge occurs.

Key to the S. African species of Zeriassa.

1. Shaft of flagellum short, very broad at the anterior bend, being there almost twice the width of the fang below it, thence gradually narrowing towards the middle where a slight twist occurs and the shaft bends outwards slightly, ending in a point (apparently) a short distance beyond the basal enlargement. Basal enlargement with triangular outline when viewed from the side. Dentition of single series of upper jaw continuous, including five teeth: lower jaw with one intermediate tooth.

Z. cuneicornis Purcell.

2. Shaft of flagellum very broad throughout its length, tapering somewhat up to the distal twist but expanded a little near the apex, which carries a short slender hook-like process: it extends only a trifle beyond the basal enlargement. Upper jaw with six teeth in the single series: lower jaw with two intermediate teeth, and the distance from the tip of the fang to the apex of the first tooth is subequal to the distance between the apices of the two large teeth.

Z. purcelli Hewitt.

Genus Daesia Karsch.

Daesia subulata Purcell, 1899. *Annals S. Af. Mus.* 1. p. 393, fig. 12.

The type male came from Van Wijk's Vlei, Carnarvon.

Daesia bernhardi Pocock, 1900. *Annals Mag. Nat. Hist.* 7, VI. p. 317.

The type is a female from Hex River Valley. The character of spines and ridges on the sides of the abdomen inferiorly, considered by Pocock to be distinctive of this species, occurs also in *leipoldti*, *lineata*, and probably also in other species. I may remark that these structures are easily overlooked, for the sides of the abdomen are densely hairy and the spines and ridges quite small. To see them it is necessary to stretch out the integument and examine

under the low power of a compound microscope. The ridges mentioned by Pocock (7) occur in the soft skin of the sides inferiorly, immediately lateral to the interval between sternites III and IV. The spines on the soft skin of various segments, as specified by Purcell (12) who described them as "claw-like," are all quite slender.

Daesia namaqua Kraepelin, 1899. *Das Tierreich*, p. 94, fig. 63.

The type came from Gt Namaqualand, and Kraepelin records it also from Steinkopf in Little Namaqualand.

Daesia betschuanica Kraepelin, 1908. *Denk. med. nat. Gesell. Jena*, XIII. p. 273.

The type male came from Lobatsi.

Daesia kolbei Purcell, 1899. *Annals S. Af. Mus.* I. p. 391, fig. 10.

This is founded on a female specimen from Bulawayo.

Daesia pallida Purcell, 1899. *Annals S. Af. Mus.* I. p. 382, fig. 11.

The type is a female specimen from the Kenhárt div. C.P.

Daesia leipoldti Purcell, 1899. *Annals S. Af. Mus.* I. p. 388, fig. 9.

This species is based on female specimens from the Clanwilliam div. C.P.

Daesia hottentotta Kraepelin, 1899. *Das Tierreich*, p. 95, fig. 64.

According to Kraepelin, this is the commonest species of South West Africa, and he records it from various localities in Damaraland and Gt Namaqualand.

An example from Mt Temple, Bechuanaland (T. C. Lanham) is perhaps referable to this species. It has a flagellum like that of *lineata*, and along the middle is a dark midrib. The dentition of the upper jaw is not very different from that of *lineata*: the single series includes four teeth, of which the first and third are of moderate size, being not much smaller than the second and fourth, and the inferior outline of the fang is curved, not straight. The same form occurs at Upington (Miss Lennox).

Daesia lineata Pocock [Pls. VI, figs. 27, 28 and 31, and VIII, fig. 43], 1902. *Ann. Mag. Nat. Hist.* 7, x. p. 7, Pl. II, figs. 3, 3 a and 3 b. = *D. schreineri* Purcell, 1903, *Annals S. Af. Mus.* III. p. 14, Pl. I, fig. 11.

The type of this species was regarded as representing a distinct genus, and was described by Pocock under the name of *Broomiella lineata*. I am satisfied that Pocock's specimen was an aberrant example of the same species as was described subsequently by Purcell as *D. schreineri*. The most noteworthy feature of Pocock's specimen, according to the figure, is the small size of the fourth tarsus, which apparently is shorter than the third, and even the claw of the fourth is represented as shorter than that of the third tarsus. Now, in the genus *Daesia*, the claw of the fourth leg is normally much longer than that of the third, and so also is the tarsus as a whole, but occasionally exceptions are found. The exceptions observed by me are without doubt referable to the species *D. schreineri*, agreeing with normal examples of that species in the dentition and in the flagellum, and indeed are only remarkable in the characters of the fourth leg. In an adult male from Hopetown tarsus IV of the right side is normal, but the left tarsus IV is two-jointed, the whole leg being shorter than that of the right side, although its basal segments bear five malleoli: the tarsal claws of the shorter leg are noticeably short, being shorter than those of tarsus III, and the tarsus as a whole is only a little longer than

tarsus III. Again, a small female example from De Aar, where typical examples of *schweineri* occur, has the left fourth leg normal throughout, but the right leg is short and its tarsus two-jointed with quite short claws: there are five malleoli as usual. The peculiarities of these aberrant specimens are perhaps the result of injury during earlier stages in the life of the individual.

It should be noted that Pocock's figure of the flagellum does not represent that organ so correctly as the figure accompanying the description of *schweineri*, assuming the identity of the two species.

The type of *lineata* came from Pearston: that of *schweineri* from Hanover. We have the species from De Aar (S. C. Cronwright-Schreiner and Miss E. Friedlander), Tafelberg (Miss A. Gadd), Longhope (Miss E. Abrahamson), Zandkraal near Steytlerville (Miss A. Geard), Hopetown (Miss Stegmann), Smithfield (Dr R. Broom), and female specimens apparently referable thereto from Klerksdale near Middelburg (B. Marais).

The stridulatory ridges of the chelicerae are decidedly longer than in *Solpuga*, but are only 4-6 in number: the bristles on the mesial surface are much as in *Solpuga* and the feather bristles towards the distal end of the series are not enlarged. The lower jaw has feathered bristles on its mesial surface: the distance from the tip of the fang to the apex of the first tooth is about equal to $1\frac{1}{2}$ times the distance between the apices of the two large teeth: the intermediate tooth may be present or absent in male specimens from the same locality. In side view, the lower margin of the terminal fang of the upper jaw is quite straight: this seems to be a very constant character.

Rotated forwards, the flagellum either just reaches the tip of the fang, or slightly surpasses, or scarcely reaches the tip: during life this probably can be rotated through an angle of 180° , or slightly more, but not very much more.

The tarsus of the palp is slightly movable in both sexes: this is not the case in *Blossia*.

Daesia rhodesiana Hewitt, 1913. *Annals Transvaal Mus.* iv. p. 165, fig. 26.

The type male came from Lundi River, S.E. Rhodesia.

Daesia schultzei Kraepelin, 1908. *Denk. med. nat. Gesell. Jena*, XIII. p. 274, figs. 5 and 6.

The type is an adult male from the Kalahari.

Key to the S. African species of Daesia Karsch.

1. Upper jaw with a very long slender toothless terminal fang. Teeth of single series absent. Flagellum drawn out behind into a straight subulate shaft which exceeds the basal disc in length.

D. subulata Purcell.

2. Terminal fang of upper jaw rather long, followed by the single series of four teeth—two fairly large ones in front, then a small one, and then a large tooth. Flagellum drawn out into a shaft which is longer than the disc.

D. namaqua Kraepelin.

3. Terminal fang of upper jaw of moderate length or short, the single series of teeth continuous; the flagellum more or less elongated and pear-shaped, without a long shaft, though drawn out a little distally.

a. The single series of teeth in the upper jaw comprises two large ones in front, one small intermediate tooth, followed by a large tooth.

D. hottentotta Kraepelin.

b. Dentition similar to that of *hottentotta* but two small intermediate teeth in the single series.

D. pearsoni Hewitt.

c. The single series of teeth in the upper jaw comprising one small one in front, then a large one, then a small intermediate tooth, and finally a large one.

D. lineata Pocock.

4. Terminal fang of moderate length. Flagellum attenuated distally but not produced into a long shaft. Basal tooth of lower jaw with a broad more or less truncated apex. In the upper jaw, the longest and largest tooth is separated from the distal tooth by a deep bay:

a. This bay including one small tooth.

D. betschanica Kraepelin.

b. The bay being quite toothless.

D. rhodesiana Hewitt.

5. Terminal fang of upper jaw specially long, followed by a single series comprising only two teeth, both of which however are large. Flagellum continued beyond the capsule into a short dorsal process and a longer ventral one, connected together by a fold of membrane, the latter process being less than half the length of the capsule.

D. schultzei Kraepelin.

Genus *Blossia* Simon.

Blossia setifera Pocock, 1900. *Ann. Mag. Nat. Hist.* 7, v. p. 301, fig. 6.

The type male came from Salisbury, Mashonaland.

Blossia namaquensis Purcell, 1901. *Annals S. Af. Mus.* II. p. 211, fig. 2.

The type male came from Steinkopf, Namaqualand, C.P.

Blossia unguicornis Purcell [Pls. VII, figs. 39 and 40, and VIII, figs. 44 and 46], 1901. *Annals S. Af. Mus.* II. p. 213, fig. 3.

Types from Dunbrody, Uitenhage div., and the species is also known to me from Alicedale (F. Cruden), Somerset East (E. Driver), and Linedrift, Peddie (B. Marais).

In the male the head-plate is beset with short spinules, but each eye is protected on its mesial side by a curved row of upstanding spines: the chelicerae have numerous, rather short, sharp pointed, stout spines and a few long ones superiorly, and the thoracic tergites are also fringed with pointed spines: abdominal tergites with very short spines and weak spinules, the posterior one or two tergites with slender setae which are slightly notched at the tips: a few spines occur on the upper surfaces of the trochanters and femora of legs II-IV.

In the females of *unguicornis*, and probably of other species also, the head-plate is armed with short spinules or prickles, and the tergites and chelicerae with spines: these spines are not so strong nor so numerous as those of the male, the first tergite for example having a single row of long slender spines in the female, but far more numerous, shorter and much stouter spines, constituting more than one row, in the adult male.

Female characters are by no means constant throughout the genus *Blossia*. In a female from N.W. Gordonia, the tergites and chelicerae are armed with long and rather stiff setae, but not with spines, and the head-plate is devoid of spinules: moreover, the jaws are more slender and longer than in females of *unguicornis*.

In this genus, modified fleshy hairs on the sternites are not confined to the adult males, nor to the second sternite, although most strongly developed on that sternite in males. In adult females of *B. unguicornis* there occurs a mesial papilla on both fourth and fifth sternites: this papilla is split down the middle, and carries on each side a long pinkish thickened hair like those on the second sternite of males, but not nearly so stout. They also occur on the same sternites in the adult male.

Similar modified hairs occur in a female *Blossia* (cp. *setifera* Poc.) from Salisbury, being found on all three sternites II, IV and V: on II there are three or four modified hairs on each side, but in IV and V only two hairs occur on each side of the midline: they are situated rather further apart than in *unguicornis*.

These modified hairs are probably homologous with the stigmatic combs of the Galeodidae: the combs of *Galeodes* occur on the second and third sternites, and modified setae in a corresponding position are found also on the fifth sternite.

Blossia crepidulifera Purcell, 1901. *Annals S. Af. Mus.* II. p. 215, fig. 4.

The type came from Robertson C.P., and Dr Purcell cited also several records in the Worcester div.

Blossia karrooica Purcell, 1901. *Annals S. Af. Mus.* II. p. 217, fig. 5.

The types were taken at Prince Albert C.P.

Blossia litoralis Purcell, 1903. *Annals S. Af. Mus.* III. p. 4, fig. 3.

Types from the western shore of the Cape Peninsula.

Blossia lamnicornis Hewitt, 1919. *Annals Transvaal Mus.* VI. p. 65.

The type was taken at De Aar, C.P.

The point of origin of the flagellum is a little posterior and dorsal to the distal end of the row of feather bristles.

Blossia falcifera Kraepelin [Text fig. 10 a], 1908. *Jena. Denkschr.* XIII. p. 277, fig. 8.

This species is known from the neighbourhood of Windhuk: other localities cited are Neudamm and Tsumab. I have previously recorded the species from Quibis in Gt Namaland, and it is known to me also from Douglas C.P. (Dr R. Broom). These southern specimens do not agree absolutely with Kraepelin's figure of the type, but the flagellum is very similar throughout, and I think it advisable to regard such differences as occur in the dentition as of varietal value only. The lower jaw of the type, which is figured with five teeth, instead of four as occur in the specimens examined by me, is perhaps abnormal, for, according to the description, the type specimen presents considerable differences in this respect in the jaws of the two sides. In the upper jaw of the type, the terminal fang is fairly large; the distance from the tip to that of the first tooth being however distinctly less than the distance between the apices of the first and fourth teeth. The example from Quibis

is not very different, but the terminal fang is a trifle shorter, the distance from its tip to that of the first tooth being considerably less than the distance between the first and fourth teeth.

The male from Douglas is markedly different from the above, the terminal fang of the upper jaw being longer and more slender: the distance between the tip of the fang and the apex of the first tooth is equal to, or very slightly greater than, the distance between the apices of the first and fourth teeth. This variety may be termed var. *dolichognathus* (Text fig. 10 b).

The distal dorsal bristle in all these specimens reaches to a point about midway between the first tooth and the tip of the fang, or a trifle nearer to the first tooth: its surface is minutely prickled almost up to the pointed apex, which tapers gradually. On the outer side of the upper jaw there is an oblique row of simple bristles, the bases of which are in a line more or less parallel with the dental series. These bristles vary much in length and size, some being quite short, others long: the most distal one, arising from a point opposite to the base of the lamina, is markedly stouter than the rest, and its surface is minutely prickled. In the allied species *B. filicornis mihi*, this row of bristles



Text fig. 10, a and b. *Blossia falcifera* Kraepelin. (a) Upper jaw of male from Quibis, viewed from outer side. (b) Ditto of var. *dolichognathus* from Douglas.

is much more uniform, the distal one being scarcely stouter than the second, and the first three have prickled surfaces. In both species, the slender apex of the flagellum is upcurled.

Blossia fimbriata Kraepelin, 1914. *Beit. z. Kenntnis d. Land- u. Süswasserfauna Deutsch-Südwestafrikas*, p. 128, fig. 3.

The locality of the type is simply "Deutsch-Südwestafrika." It seems to be very distinct from any other species known from S. Africa.

Blossia echinata Purcell, 1903. *Annals S. Af. Mus.* III. p. 16, Pl. I, fig. 10.

The types came from Hanover C.P.

Blossia maraisi Hewitt, 1915. *Records Albany Mus.* III. p. 70, fig. 1.

The type male came from Peddie.

Blossia tricolor Hewitt, 1913. *Annals Transvaal Mus.* IV. p. 156, fig. 20.

The types were collected at Quibis in Gt Namaland.

Blossia clunigera Kraepelin, 1908. *Jena. Denkschr.* XIII. p. 275, fig. 7.

The type was taken at Steinkopf in Little Namaqualand.

Blossia obscura Kraepelin, 1908. *Jena. Denkschr.* XIII. p. 278.

This is based on a female from Khakea in the Kalahari.

Blossia filicornis Hewitt, 1913. *Annals Transvaal Mus.* IV. p. 158, figs. 21 and 22.

The types were taken at Alt Wasserfall in Gt Namaland.

Blossia laticosta Hewitt, 1919. *Annals Transvaal Mus.* VI. p. 64.

The type was taken at Blauwkoop in the Zoutpansberg dist.

Key to the S. African species of the genus Blossia Simon.

A. Flagellum long and slender, widest near the base, tapering more or less gradually to the apex, and when directed forwards extending considerably beyond the tip of the upper jaw: basally, it is membranous with in-curved edges forming a more or less inflated capsule, with a greatly elongated aperture on the side adjacent to the jaw: distally, this gradually becomes a flattened rod.

a. On the lower margin of the fang of the upper jaw, between the tip of the fang and the first large pointed tooth, there is a tooth-like projection formed by a laterally compressed obtuse lamina.

1. Distal dorsal bristle with proximal half stout and minutely granular (except at the base), the distal half more slender, subulate, and smooth. Flagellum suddenly acuminate at the apex when seen from the side.

B. karrooica Purcell.

2. Distal dorsal bristle hardly reaching so far as the first pointed tooth, slender and quite devoid of granulation in any portion of its length, being precisely similar to the other bristles of the neighbourhood. Distal portion of the flagellum more slender than that of *karrooica*, and not so suddenly acuminate at the apex.

B. maraisi Hewitt.

b. No pronounced tooth-like lamina between the tip of the upper jaw and the first large tooth (it is represented by a minute tubercle or slight convex dilatation in *echinata*).

3. Distal dorsal bristle short¹, hardly reaching so far as the first tooth, its surface minutely granular. Basal half of flagellum of more or less uniform width, thence becoming gradually attenuated towards the apex where it is slightly hooked.

B. setifera Pocock.

4. Distal dorsal bristle almost reaching to the tip of the fang, its surface minutely roughened in the distal half. Flagellum with a broad basal half and a rod-like distal half fairly sharply differentiated. Dorsal edge of upper jaw furnished with a small sharp tooth which is almost midway between the base of the distal dorsal bristle and the tip of the fang.

B. echinata Purcell.

5. Distal dorsal bristle strong and boldly curved, reaching about as far as the anterior border of the second tooth, tapering more or less uniformly throughout its length, and not very strongly denticulated on any part of its surface. Flagellum very much broader towards the base than in the distal

¹ This character is inferred from the figure of the type.

portion, the whole structure being fairly regularly attenuated from the widened basal portion up to the apex. The first tooth of the upper jaw is much nearer to the second than to the tip of the fang.

B. falcifera Kraepelin.

6. Distal dorsal bristle very stout in its basal two-thirds, where the surface is rather strongly denticulated except near the base; then becoming attenuated rather suddenly, the apical third being slender, smooth and tapering to a fine point. Flagellum quite slender, being only slightly expanded at the base, and the distal half being practically uniform in breadth throughout. The first tooth of the upper jaw is as near to the second as to the tip of the fang.

B. filicornis Hewitt.

B. Flagellum short, not or scarcely surpassing the end of the fang when directed forwards, the distal portion being expanded into a widely open capsule, more or less oval or pear-shaped in outline, and the basal portion forming a distinct narrow stalk of attachment.

7. Distal portion of upper jaw with a long and straight upper margin, the first three teeth subequal in size, the third being followed by a fairly long straight interval, the fourth tooth being small. Distal dorsal bristle long and straight, minutely echinated in its distal half, which is as stout as the basal half.

B. crepidulifera Purcell.

8. Distal portion of upper jaw curved towards the apex; the single series is continuous and includes two strong pointed teeth distally, followed by two small teeth: between the more distal pointed tooth and the tip of the fang, is an inner blunt laminate tooth paired with an outer more conical tooth. Distal dorsal bristle undifferentiated.

B. litoralis Purcell.

9. Similar to *crepidulifera*, but the distal portion of the upper jaw is curved: the single series comprises two large distal teeth, a small third tooth, and a large fourth in a continuous series.

B. clunigera Kraepelin.

C. Flagellum a more or less pear-shaped capsule, with a wide elongated opening over the distal half or two-thirds of its length, the basal funnel-shaped part narrowed but not definitely petiolate.

10. Distal part of flagellum broad, densely covered with shaggy hairs. Outer wall of flagellum furnished with a strong well-marked yellow axis which terminates distally in a short sharp claw. Second abdominal segment inferiorly carrying two pairs of sickle-shaped fleshy hairs situated near the midline.

B. unguicornis Purcell.

11. Second abdominal segment inferiorly with two groups of three fleshy hairs near the midline. Flagellum without prickles or setae on its surface, although the distal edges are slightly frayed: the yellow thickened rib is very broad, and the amount of free membrane dorsal to it is much less than in *unguicornis*.

B. laticosta Hewitt.

12. Flagellum without a longitudinal thickened rib. Between the first large tooth of the upper jaw and the tip of the fang, there is a small obtuse tooth (which is absent in *unguicornis*).

B. tricolor Hewitt.

D. Flagellum like that of C, but widest about the middle of its length and gradually tapering distally to a slender apex.

13. Lateral wall of flagellum furnished along its middle with a thick pale yellow longitudinal rib, extending throughout the whole length: surface of flagellum thickly studded with prickles right up to the apex. Distal dorsal bristle becoming gradually thinner towards the apex, and covered with very minute spinules in its distal part. Third tooth of upper jaw rudimentary.

B. namaquensis Purcell.

14. Third tooth of upper jaw only a little smaller than the first or the second. Distal dorsal bristle precisely similar to the other bristles which occur on the upper and outer surfaces of the chelicerae, and with only a trace of short fine setose prickles on its distal portion. Surface of flagellum closely studded with minute triangular denticles, except towards the base, and on the narrowed distal portion.

B. laminiornis Hewitt.

E. Flagellum long, reaching beyond the tip of the fang when directed forwards; not very broad in any part, nor greatly attenuated either towards the apex or the base; the cavity of the slightly expanded capsule, which occupies the distal portion of the basal half of the flagellum, has a short oval aperture: the lancet-shaped distal half of the flagellum is lightly curved, and the membrane bordering it along the upper or anterior margin is very finely serrated from the capsule almost up to the apex.

B. fimbriata Kraepelin.

Genus *Gluviopsis* Kraepelin.

Gluviopsis australis Purcell, 1901. *Annals S. Af. Mus.* II. p. 219, fig. 8.

The type came from Styrkraal near the Orange River in the Kenhardt div.

This is the only species described from S. Africa, but Kraepelin gives some notes on a female example of the genus from Swakopmund.

The flagellum of *australis*—which is only known to me through the description and figure—is more or less oblong in shape, tapering towards the base, strongly compressed and bent outwards distally, the apex being very broadly subtruncated and lacerated. There are four large teeth in the single series of the upper jaw.

Genus *Hemiblossia* Kraepelin.

Hemiblossia bowvieri Kraepelin, 1899. *Das Tierreich*, p. 104, fig. 77.

This is based on a single female specimen from the upper Zambesi.

Hemiblossia O'neili Purcell [Pls. III, fig. 5 and VIII, fig. 42], 1901. *Annals S. Af. Mus.* II. p. 217, figs. 6 and 7.

This is based on several males and females from Dunbrody on the Sundays River. Also known to me from Alicedale (F. Cruden), De Aar (S. C. Cronwright-Schreiner) and Kimberley (Bro. J. H. Power). A figure of the flagellum of Alicedale specimens is given by me in *Records Albany Mus.* vol. III. p. 12. The inner surface of the chelicera in both sexes has stridulatory ridges, simple bristles, and feathered bristles, as usual.

Hemiblossia kalaharica Kraepelin, 1908. *Denk. med. nat. Gesell. Jena*, XIII. p. 279.

The type is a female from Khakhea in the Kalahari.

Hemiblossia idioceras Hewitt, 1917. *Ann. Natal Mus.* III. p. 687, fig. 1 a-c.

This is based on an adult male from Kimberley. The species seems well separated from *O'neili* in the characters of the flagellum, and it is of interest to note that both forms have been taken at Kimberley.

Mr Claude Fuller has taken this species at Pienaar's Riv. Transvaal: it occurred in numbers within the nest of a *Eutermes*. Mr J. H. Power also found adult males in a termites' nest at Kimberley, Nov. 1918.

Key to the species of Hemiblossia Kraepelin.

1. Dorsal margin of flagellum rather strongly curved, though not quite semicircular, and at its distal end is an independent process which is slender, curved and hairy: the distal margin of the flagellum is somewhat flattened out, but not into a distinct foliaceous appendage.

H. O'neili Purcell.

2. Dorsal margin of flagellum lightly curved, distally with an acutely pointed termination: distal margin of flagellum flattened out on the side adjacent to the chelicera into a foliaceous extension the margins of which are fringed with hairs.

H. idioceras Hewitt.

Genus Melanoblossia Purcell.

Melanoblossia braunsi Purcell, 1903. *Annals S. Af. Mus.* III. p. 6, figs. 4 and 5.

The type came from Willowmore, and a juvenile specimen was taken at Hanover.

Melanoblossia globiceps Purcell, 1903. *Annals S. Af. Mus.* III. p. 8, fig. 6.

Type from O'okiep in Little Namaqualand.

Key to the species of Melanoblossia Purcell.

1. "Flagellum" inconspicuous, being a straight hairy rod, like the setae immediately below it. Head-plate moderately convex, with notched setae of varying length, but not densely clothed with minute cylindrical bristles. Six small teeth in the single series of the upper jaw. Second abdominal sternite with two pairs of long narrow pointed fleshy hairs.

M. braunsi Purcell.

2. "Flagellum" similar, but much larger and more conspicuous. Head-plate strongly convex, the posterior surface rising vertically, the surfaces thickly covered with very short and numerous blackish brown cylindrical or pointed bristles. Four small recurved teeth in the single series of the upper jaw. Second abdominal sternite with 8-12 pairs of filiform fleshy hairs.

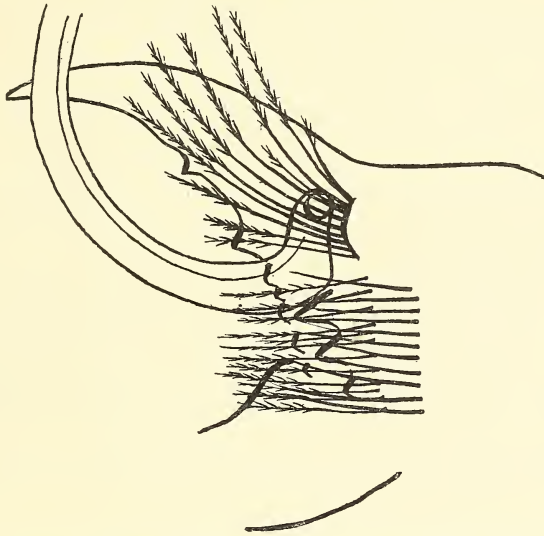
M. globiceps Purcell.

Genus Toreus Purcell.

Toreus capensis Purcell, 1899. *Annals S. Af. Mus.* 1. p. 399, figs. 15-15 b.

Originally described as a species of *Ceroma*, the genus *Toreus* being afterwards founded for its reception (*Annals S. Af. Mus.* III. p. 9, fig. 7, 1903).

The type came from the farm Bergvliet in the Cape Peninsula. According to the description, the most striking feature of the species is that presented by the fang of the upper jaw, which is long and slender and divided into two portions: the shorter basal portion is directed forwards: the longer distal portion, which is a continuation of the median half of the basal portion, is bent sharply outwards from the base, forming a right angle with its fellow of the other jaw. The lower jaw is also strongly curved upwards and outwards at the apex. The single series of teeth in the upper jaw is represented only by a low black crenular keel without any separate teeth.



Text fig. 11. *Ceroma pictulum* Pocock. Mesial surface of upper jaw, with base of flagellum.

Genus Ceroma Karsch.

Ceroma sclateri Purcell, 1899. *Annals S. Af. Mus.* 1. p. 395, fig. 13.

The type male came from Houwhoek, Caledon div. C.P.

An immature specimen was also recorded from Ashton, Robertson div. It was recorded from Damaraland in *Das Tierreich*, but this was evidently an error, as is now admitted by Kraepelin.

Ceroma inerme Purcell, 1899. *Annals S. Af. Mus.* 1. p. 398, fig. 14.

The type male came from "Walfish Bay."

Ceroma pallidum Pocock, 1900. *Ann. Mag. Nat. Hist.* 7, v. p. 305, fig. 7.

The type male is from Garies in Little Namaqualand.

Ceroma pictulum Pocock [Pl. V, fig. 20 and Text fig. 11], 1902. *Ann. Mag. Nat. Hist.* 7, x. p. 8, Pl. II, fig. 2.

The type male was taken at Teafontein near Grahamstown. The species described by me under the name of *C. leppanae* (*Records Albany Museum*, III. p. 10, fig. 3) is probably referable to *pictulum*, although according to the donor of the specimen it came from Bulawayo. Mr S. Hirst has recently supplied me with notes on the type of *pictulum* as follows: flagellum very long and fine, reaching well beyond the hind margin of the head-plate, slightly expanded and truncate at the tip, the truncated edge being frayed out into short pointed processes, visible under the low power of a compound microscope: on the second and third legs, the patella has only a single very short spine at the distal end, and the tibia has three dorsal spines.

In the type of *leppanae*, there are no stridulatory ridges on the chelicerae: the upper surfaces of the chelicerae carry long stiffish bristles: the bristles protecting the base of the flagellum are all feathered: ocular tubercle elevated, being slightly but distinctly higher above the head-plate than in *Solpuga*, *Daesia*, *Blossia* or *Chelypus*: tarsus IV not spined: claws of tarsus I only just visible under a magnification of about 10 diameters.

The compact fan of feather bristles, protecting the base of the flagellum, arises from a short outstanding projection of the surface of the chelicera, and is presumably derived from the distal portion of the series of feather bristles that normally fringes the jaw in this family: nevertheless that series is represented in *pictulum* by a row of weakly developed feather bristles, more basally situated, and separated by an interval from the fan of stout bristles. The fan includes also one or two weak spines or simple bristles. As usual there is a row of simple bristles parallel to that of feathered ones.

The shaft of the flagellum resembles that of *Chelypus*. It is furrowed along its length and seems to be essentially a folded membrane: basally the furrow passes into a small inflation on the mesial side. It is rotatable at the base, a fact which seems to have been overlooked by Pocock, as well as by myself when describing *leppanae*: possibly the flagellum of other species may be fixed, for no one has hitherto recorded a rotatable flagellum in this genus.

Ceroma focki Kraepelin, 1914. *Beit. z. Kenntnis d. Land- u. Süswasserfauna Deutsch-Südwestafrikas*, p. 134, fig. 5.

The type male is labelled Windhuk.

Key to the S. African species of Ceroma.

A. The single series of teeth in the upper jaw composed of four teeth in a continuous row, the third being small. Flagellum comparatively short, considerably expanded in the basal half but narrower towards the apex.

1. Apex of flagellum filiform: the basal expanded portion protected on the mesial side by one strong spine and beneath it two bristles which are stout at the base and filiform at the apex. *C. pallidum* Pocock.

2. Apical portion of flagellum stouter, and bent strongly backwards into a hook: on the mesial side, the flagellum is flanked by two strong spines one near the base and one near the apex, whilst on the outer side there are three stout spines near the basal expanded portion. *C. focki* Kraepelin.

B. The single series of teeth in the upper jaw with only two teeth, the basal one much the larger, the distal tooth considerably separated

therefrom, being situated slightly in front of the anterior bend of the flagellum: flagellum long, reaching back well beyond the hind margin of the head-plate, not expanded into a pear-shaped enlargement at the base. Tibiae II and III with three short stout dorsal spines.

C. pictulum Pocock.

C. The single series of teeth in the upper jaw comprising two teeth, both rather large, not appreciably separated from each other. Flagellum long and slender.

1. Flagellum with a pear-shaped enlargement near the anterior bend, its apex reaching almost to the hind margin of the head-plate: tibiae II and III with three short stout spines dorsally.

C. sclaieri Purcell.

2. Flagellum strongly compressed laterally at the anterior bend, but at the basal end it is scarcely enlarged, its apex reaching to the hind margin of the ocular tubercle: tibiae II and III with several strong bristles dorsally.

C. inerme Purcell.

Genus *Lipophaga* Purcell.

Lipophaga trispinosa Purcell, 1903. *Annals S. Af. Mus.* III. p. 11, fig. 8.

The type came from Stompneus and Soldatenpost at St Helena Bay, C.P.

Lipophaga schultzei Kraepelin, 1908. *Denk. med. nat. Gesell. Jena*, XIII. p. 280, figs. 9-10.

This was originally described as the type of a distinct genus, *Pseudoblossia* Krpln., since recognised by its author as identical with *Lipophaga*.

The types came from Kamaggas in Little Namaqualand.

Lipophaga michaelsoni Kraepelin, 1914. *Beit. z. Kennt. d. Land- und Süßwasserfauna Deutsch-Südwestafrikas, Skorpiones und Solifugae*, p. 132, fig. 4.

The type came from Lüderitzbucht. A female from Okahandja was described at the same time, and referred with some doubt to this species.

Key to the species of *Lipophaga* Purcell.

1. The single dental series of upper jaw with six teeth, the third and sixth being largest, the first of moderate size. Terminal fang of upper jaw much shorter than that of lower jaw.

L. trispinosa Purcell.

2. Similar to *trispinosa*, but first tooth of upper jaw very much larger than the third, being in fact the largest of the series.

L. michaelsoni Kraepelin.

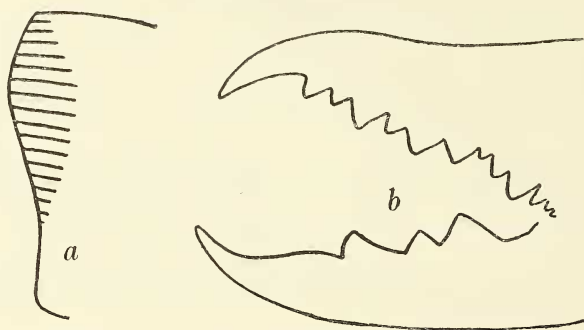
3. Terminal fang of upper jaw as long as that of the lower jaw.

L. schultzei Kraepelin.

In Kraepelin's definition of the genus *Pseudoblossia*, the tarsus of the fourth leg is said to be at least six times as long as deep, and the first leg without tarsal claws: the chelicerae have stridulatory ridges reaching almost up to the middle of the inner surface, the male with about 16 such ridges. Purcell's definition of *Lipophaga* includes: tarsus I with a pair of minute claws: chelicerae with a series of very short ridges at the anterior edge of the large smooth area.

Kraepelin referred the genus to the Daesiinae, but Purcell included it in the Karschiinae. The species are of moderate size, the adult male measuring $15\frac{1}{2}$ –17 mm. in total length, and the female $20\frac{1}{2}$ –22.

A series of female specimens belonging to this genus was taken recently by Dr R. Broom in the Campbell district: according to Dr Broom, the species is found over the dolomite area, extending from a point about 40 miles north of Campbell to 30 miles north-west of that village. In these examples the first tarsus is clawed: the tarsus of the fourth leg is about 5–6 times as long as deep, has no unguis appendages, and is rather densely clothed inferiorly with stiff setae: tibia III with a row of three very strong dorsal spines, also three weaker ones in a row posterior thereto: patella III with one strong spine at the apex dorsally: fourth leg without spines: the chelicerae have about 15 comparatively short stridulatory ridges, as shewn in the adjoining figure: the single series of teeth in the upper jaw is unbroken, the first and second teeth being of moderate size, the third large, the fourth moderate, the fifth and sixth rather large; coxa of palp with a long maxillary process: anterior margin of head-plate a little curved, upper surface with a well marked mesial groove and armed with long stiff setae and hairs like those on the chelicerae, with two



Text fig. 12. *Lipophaga* sp. Female example from neighbourhood of Campbell, shewing: *a*, the stridulatory ridges on the inner surface of the chelicera; *b*, the jaws viewed from the outer side.

prominent bristles in front of the ocular tubercle: the lateral portions of the head-plate are separated off from the mesial portion by a continuous suture as in *Chelypus*: in the interarticular membrane between the fourth and fifth sternites there is a distinct but minute median stigma: sides of abdomen only very sparsely hairy, the hairs being stiff and outstanding, with conspicuous pits arranged roughly in transverse rows.

The largest example measures 28 mm. in total length (including the chelicerae), the head-plate being 5 mm. broad.

Genus Hexisopus Karsch.

The family Hexisopodidae was constituted by Mr R. I. Pocock (*Ann. Mag. Nat. Hist.* 6, xx. p. 250) for the reception of the remarkable genus *Hexisopus*, which at that time was very imperfectly known. The adult male had not been described and one of the two known species was based on a very young specimen, so that a character now known to be common

to juveniles throughout the order, viz. the presence of only three malleoli on the hind limb, was represented as characteristic of *Hexisopus* and was even included in the definition of the family *Hexisopodidae*. Other more important characters were of course mentioned in the original definition and all later writers have agreed in recognising the family. The best account of the genus is that given by Dr Purcell (9) who sums up the principal points of distinction from the *Solpugidae* as follows: the absence of one joint of the trochanters in each leg of the three posterior pairs: the absence of claws in leg IV: the extreme shortness of the distal portion of leg IV in proportion to the basal part: the length of the distal segment of the claws in legs II and III: the minuteness of the third tarsal segments in these legs: the absence of subungual appendages in these legs: the presence of a genital papilla in the male: the shortness of the upper lobe of the rostrum.

Prof. Kraepelin in *Das Tierreich* also relies mainly on the characters of the legs in distinguishing this family from the *Solpugidae*: the great length of the segment now termed the trochantin and the shortness of the femur of the fourth leg is cited as an important character, and indeed the difference from the other known S. African genera in this respect is very striking. Other characters mentioned by Kraepelin in his diagnosis of the family, in addition to some of those emphasized by Dr Purcell, are:—mandibles with anastomosing stridulatory ridges: mandible of male almost toothless: ocular tubercle conical, forwardly projecting, and very hairy anteriorly: characters of the male flagellum.

In my opinion none of these characters can be regarded as equivalent in importance to those which distinguish the two main families of *Solifugae*, viz. the *Galeodidae* and the *Solpugidae*. The great reduction in length of the distal segments of the legs, the strong development of spines on these segments and the disappearance of the tarsal claws of the fourth leg are doubtlessly to be regarded as adaptation characters, in accordance with the burrowing habit: such differences between *Hexisopus* and a typical *Solpugid* can be compared with those which exist between our short limbed, stout bodied, burrowing frogs (*Rana delalandi* Tschudi) and the long limbed, slender, grass frogs (*Rana fasciata*) of the same genus, and indeed are not very much greater than those which separate the sedentary females of the genus *Stasimopus* (trap-door spider) from the free-living adult male of the same species. The supposed reduction in number of the trochanter segments is incorrect, being based on an error of homology. The number of tarsal segments, the absence of subungual appendages from the tarsi and the absence of claws on legs IV are characters of no great importance in view of the wide variation that is now known to occur on the several legs of true *Solpugids*. The shortness of the upper lobe of the rostrum is apparently a feature peculiar to *Hexisopus*, and is not found in the closely related genus *Chelypus*. The stridulatory area of the chelicerae, which in *Chelypus* is not ribbed but marked with fine and quite irregular furrows, seems to be much more like that of a normal *Solpugid* in some species of *Hexisopus* where parallel stridulating ribs are present: in any case, however, the character is not of great value seeing that in the same species of *Solpuga* ribs may be

fully developed in the female but quite absent in the male. The ocular characters vary very considerably in the several Hexisopodid species, and even in the same species between male and female. The dentition of the chelicerae is a most unsatisfactory character from a systematic point of view.

The differences between the families Solpugidae and Galeodidae are apparently of a major-type, at any rate not connected with habitual differences. The Galeodidae have the stigmata of the second and third abdominal segments opening beneath the posterior edge of the sternites and protected by a pair of transversely elongated finely toothed plates the Serrulae: the stalks of the tarsal claws are hairy: the tarsus of the palp is freely articulated with the tibia. In the Solpugidae there are no serrulae protecting the abdominal stigmata (the modified hairs on the sternites in the Daesiinae may be homologous therewith), which are plainly visible on the posterior margins of the sternites: the stalks of the tarsal claws are not hairy: the tarsus of the palp is immovably attached to the tibia, or is only slightly movable thereon as in *Daesia*. In these characters, the Hexisopodidae agree entirely with the Solpugidae and I therefore propose to unite the two into one family, Solpugidae, where the Hexisopodid genera have the subsidiary rank of a subfamily, the Hexisopodinae.

In respect to the form of the head-plate and of the first thoracic tergite, the Hexisopodid genera seem to shew considerable resemblance to the genus *Rhagodes* as figured by Mr H. M. Bernard in his paper on the "Comparative Morphology of the Galeodidae" (*Trans. Linn. Soc. Lon.* 2nd Ser. Zoology, vol. vi. Pl. 27, figs. 6 and 7). These genera also resemble *Rhagodes*, more or less clearly, in the dentition of the chelicerae, in the shortness of the legs, in the small size of the eyes, and in the rather large size of the anal segment. Assuming the accuracy of Mr Bernard's figure, there is another interesting point in which *Rhagodes* differs from ordinary Solpugids and tends towards *Hexisopus*: the claw of the fourth leg is represented as smaller than that of the third leg, whereas in all genera found in S. Africa, except *Hexisopus* and *Chelypus*, the claw of the fourth leg is greater than that of any of the preceding legs. I may add that the *Rhagodinae* and *Hexisopodinae* will probably be found to occupy adjoining geographical areas, the genus *Rhagodes* extending southwards as far as Masailand, and the western genus *Chelypus* being known to me from North West Rhodesia. However, in the absence of actual material for an exact comparison between *Rhagodes* and the *Hexisopid* genera, it would be unwise as yet to lay too much stress on these points, which may prove to be explicable as the results of convergent evolution rather than of genetic affinity. At present, indeed, it is impossible to assert with any degree of confidence whether or not the *Hexisopodid* genera should be regarded as derivatives of the same immediate stock as gave rise to the other *Solpugid* genera in S. Africa.

The *Hexisopodinae* are probably more nearly related to the *Karschiinae* than to either of the other S. African subfamilies.

I have observed one character in *Chelypus*, and less distinctly in

Hexisopus, that does not appear to be present in the better known S. African genera: this is the median tracheal stigma of the fourth abdominal sternite, which however is quite small. The same stigma occurs in *Galeodes*, but not in *Rhagodes* according to H. M. Bernard¹. I have noticed it in female examples of the genus *Lipophaga*.

Hexisopus lanatus C. L. Koch [Pl. VIII, fig. 41], 1842.

Purcell in *Annals S. Af. Mus.* I. p. 384, figs. 1-7 *b*, also II. p. 221.

Recorded by Dr Purcell from localities in Namaqualand, C.P., viz. Grasmond between Steinkopf and Ramond's Drift, and from Vuurdood near Ramond's Drift, also from Bladgrond in Gt Bushmanland. Kraepelin records it from Keetmanshoop and Kabus in Gt Namaland.

Hexisopus crassus Purcell, 1899. *Annals S. Af. Mus.* I. p. 387, figs. 8 and 8 *a*.

This is founded on a single female example from Worcester. C.P.

Hexisopus nigrolumatus Kraepelin, 1899.

Das Tierreich, p. 151, fig. 117.

Founded on an adult male from Damaraland.

Hexisopus infuscatus Kraepelin, 1899. *Das Tierreich*, p. 151, fig. 118.

The type is an adult male from Walfish Bay.

The species does not seem to be very different from *lanatus* judging from the description.

Hexisopus reticulatus Purcell, 1901. *Annals S. Af. Mus.* II. p. 222, fig. 9 *a* and *b*.

The type is an adult male taken near the Orange River between Bysteeek and the Great Falls at Aughrabies.

Hexisopus fodiens Simon, 1887. *Ann. Soc. Ent. France*, 6. 7, p. 374, Pl. VI, figs. 6 and 7.

The type is an immature example from the Kalahari, and presumably the species is indeterminable. Dr Purcell has remarked on certain peculiarities (9) in Simon's figure of this species, and I may add also that the distal portion of the palp is represented with quite unique features—having apparently a lobe on the tarsus, and the latter freely articulated with the tibia—which however are not referred to in Simon's description. The figure is probably hopelessly inaccurate.

Key to the species of the Genus Hexisopus.

1. From the anterior edge of the basal cup, the shaft of the flagellum passes forwards, upwards, backwards and finally downwards in a bold curve, terminating just behind the base of the lower jaw, not far from the basal cup: the shaft is more or less cylindrical and tapers gradually to a slender apex. *H. lanatus* C. L. Koch.

¹ According to Sorensen's account, the median spiracle would seem to be normally present in Solifugae. Hansen recorded it in the genus *Rhagodes*.

2. The shaft of the flagellum is of more uniform thickness and does not taper gradually to a slender apex, the distal end being strongly compressed, blade-like, and slightly dilated: the shaft moreover is not curved throughout its length, the upper portion being directed backwards in a straight line for a considerable distance. Lower jaw long, slender, strongly curved, with a small tooth behind the middle.

H. reticulatus Purcell.

3. Towards the apex of the flagellum, the shaft presents for a short distance a small membranous expansion along the lower side: this terminates quite abruptly near to the distal end which is drawn out to a fine point. The lower jaw has a fairly large tooth with a horizontal upper edge, the distal end of the tooth being nearer to the apex of the jaw than to its base. Upper jaw with two small teeth near to the point of origin of the flagellum.

H. nigrolunatus Kraepelin.

4. Similar to *lanatus*, but tibia of palp with short cylinder bristles over the whole extent of the upper surface, the cylinder bristles of the lower surface being short distally, but those near the base of the segment gradually become longer, exceeding twice the length of the distal bristles. (In *lanatus* the tibia of the palp, dorsally and ventrally, is said to carry long hairs, rather long bristles and between them some short isolated cylinder bristles.)

H. infuscatus Kraepelin.

Genus Chelypus Purcell.

Chelypus barberi Purcell, 1901. *Annals S. Af. Mus.* II. p. 224, fig. 10.

The type is a male from a locality in Bechuanaland about 100 miles south of the junction of the Moshowing with the Molopo Rivers. The Transvaal Museum has a specimen labelled Rietfontein, Gordonia, which seems referable to this species. In this specimen, the chelicerae are not densely covered with minute pointed spinules on the upper surface, but have short subspiniform setae and some very minute spinules. The cup-like basal enlargement of the flagellum narrows into a rounded solid head which fits closely into a hemispherical depression on the surface of the chelicera.

Chelypus lennoxae Hewitt, 1912. *Records Albany Mus.* II. p. 312.

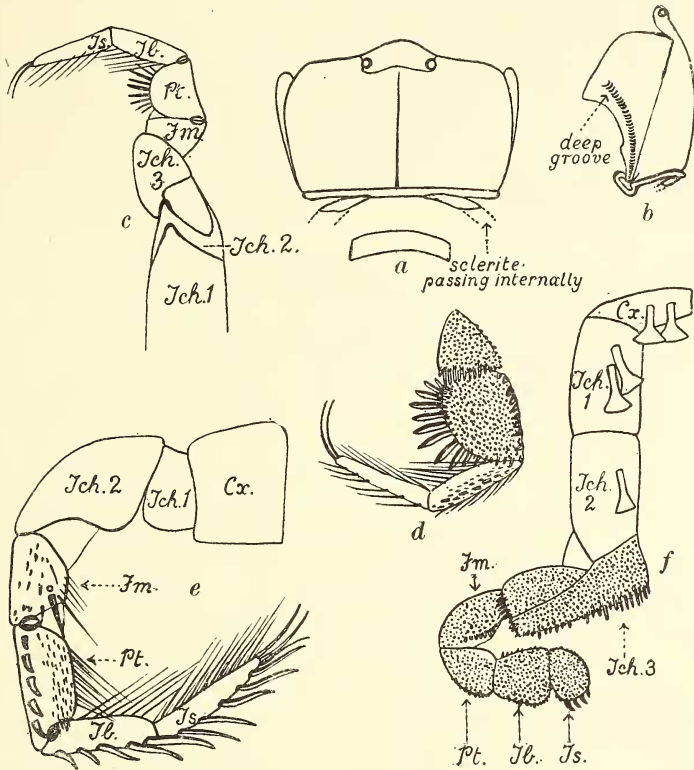
The type came from Upington.

This species is remarkable in its dark colouration, the hairs of the abdomen superiorly being brown or dark brown, and the sides quite deeply infuscated: the fourth femur is rather long when compared with the trochantin: the chelicera has comparatively coarse, black, pointed spinules on the outer portion of the upper surface and on the upper portion of the outer surface, whilst a prominent oblique patch of strong pointed spinules occurs on the mesial surface near to the base of the fang superiorly: the furrows of the stridulatory area are very long, and in general longitudinally arranged: a distinct ocular tubercle is not present, but the area on the mesial side of each eye is slightly raised: the abdominal tergites are well defined.

Chelypus hirsti Hewitt [Pl. VIII, fig. 45 and Text-fig. 12], 1915. *Annals Natal Mus.* III. p. 323, figs. 8 and 9.

The types were taken at Rietfontein in Gordonia.

The following notes may be added to the original description: eyes about seven or eight diameters apart, being situated on a more or less distinct ocular tubercle which is quite twice as broad as long and almost subdivided by a median depression into two tubercles: this ocular region projects forwards a little in front of the more lateral portions of the head-plate but is not nearly so forwardly produced as in the males of *Hexisopus*, where the eyes are much nearer together according to Purcell's accounts. Inner surface of chelicerae without feathered bristles, and with no row of spines nor even stiff bristles on the upper jaw: stridulatory area rather large, with a reticulation of furrows.



Text fig. 13. *Chelypus hirsti* Hewitt. *a*, Head-plate and thoracic tergites seen from above. *b*, Head-plate seen from the side. *c*, Third leg viewed from its upper side (this leg is considerably twisted). *d*, Distal segments of same, more enlarged, in ventral view. *e*, Second leg and *f* fourth leg.

Coxa of palps with a fairly prominent maxillary lobe: this is not so long as that of *Solpuga*, but is longer and more conspicuous than in *Daesia*. The palp has very stout spines on its surfaces, four on the tarsus, about 11 on the tibia, and several on the patella. Claws of second and third legs of two segments, but the basal segment is almost obsolete, being about one-twelfth as long as the distal segment: according to Dr Purcell, this character may vary considerably amongst the individuals of the same species (*Hexisopus lanatus*).

The anal slit is large, and the whole segment moderately large. A small median spiracle on the fourth abdominal sternite, which is also traceable in

the male of *Hexisopus lanatus* but only indistinctly in the female: thoracic spiracles very large. There is a general absence of bristles or stiff hairs on the surfaces of body and appendages, but numerous long soft and low-lying hairs occur.

Key to the S. African species of Genus Chelypus.

1. Shaft of flagellum directed forwards, upwards, backwards, and downwards in a bold curve, the apex bifid, with a short tooth-like medial branch and a longer lateral branch. Dorsal surface of upper jaw with two very large black tubercles distally. Tibia of fourth leg longer than the tarsus, and broader than the patella, but not lobed: tarsus of fourth leg broader than long. Claws of second and third leg composed almost entirely of the distal segment, the proximal segment (claw peduncle) being extremely short and indistinctly marked off. *C. barberi* Purcell.

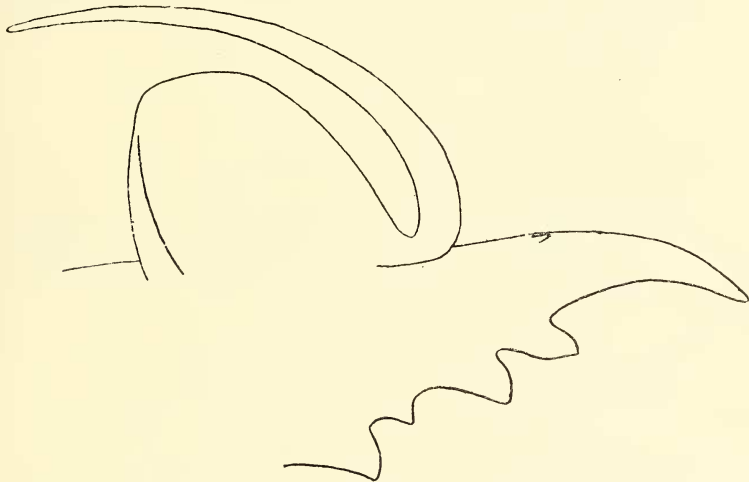
2. Similar to *barberi* but flagellum not bifid at the apex but tapering to a point. *C. hirsti* Hewitt.

3. Dorsal surface of upper jaw with only one large tubercle. Tibia of fourth leg with a large rounded lobe projecting externally and densely covered with short spinules. Tarsus of fourth leg longer than broad. Distal segment (claw proper) of tarsal claw of third leg less than half the total length of the claw and distinctly marked off from the proximal segment (claw peduncle). *C. lennoxae* Hewitt.

ADDENDUM

Solpuga niassa Karsch var. nov. *kafulica* [Text fig. 14].

What seems to be a distinct variety of this species is known to me from Kafula Futa, N. Rhodesia (Rev. C. M. Doke). The male presents considerable features in common with *schönlandi*, and, I think, will probably prove to be completely connected therewith by intermediate forms. It differs from *schönlandi* as follows: the flagellum is more slender and a little longer, the apex reaching back beyond the hind border of the basal enlargement, the recurrent portion of the shaft tapering from its commencement, rather rapidly so near the anterior bend, becoming somewhat twisted outwards distally, the apex rather bluntly pointed and with no distinct projecting core: the terminal fang of the upper jaw has the inner dorsal tooth almost obsolete: the lower border of the terminal fang well curved. Only one intermediate tooth in the single series of the upper jaw. Basal enlargement of flagellum markedly elevated as in *schönlandi*.



Text fig. 14. *Solpuga niassa kafulica* sub sp. nov. Left upper jaw of male viewed from mesial side.

In the female, there are indications of a second intermediate tooth in the upper jaw: this, which is actually the third tooth, is much smaller than the fourth, which again is considerably less than either the second or fifth.

Measurements: breadth of head-plate M. 7, F. 13; length of patella of palp M. 12, F. 14; of tibia and tarsus of palp M. 12.3, F. 14.8; of patella of fourth leg M. 10.5, F. 12.25.

According to Kraepelin's figure of *niassa* in *Das Tierreich*, the upper jaw of the male has two well developed intermediate teeth, and the flagellum has peculiar serrations on its shaft, which are not in any degree represented in the specimen from Kafula Futa. The new variety is related also to *S. rhodesiana* Hirst (*Manchester Memoirs*, LVI, 1911, No. 2, p. 8) which has two intermediate teeth in the upper jaw, whilst the flagellum is sharply pointed at the apex and distinctly shorter than that of *kafulica*.

EXPLANATION OF PLATES

PLATE I.

Fig. 1. *Solpuga venator* Poc. Adult female from Keetmanshoop.

PLATE II.

Fig. 2. *Solpuga chelicornis* Licht, var. nov. *pubescens*. Adult male from De Aar.

Fig. 3. *S. chelicornis* Licht, var. nov. *rufescens*. Adult male from Loughope.

Fig. 4. *S. derbiana* Poc. Adult female from Grahamstown.

PLATE III.

Fig. 5. *Hemiblossia O'neili* Purcell. Adult female from Alicedale: enlarged.

Fig. 6. *Solpuga sericea* Poc. ? sp. (possibly *celeripes* Hirst). Female from Salisbury.

Fig. 7. *S. lineata* Koch. Male from Alicedale.

Fig. 8. *S. chelicornis* Licht, var. nov. *rufescens*. Female from Dirkskraal.

Fig. 9. *S. venator* Poc. Chelicera of adult female from Thorn Kloof near Grahamstown: enlarged.

Fig. 10. *S. venator* Poc. Abdomen of adult female in ventral view.

Fig. 11. *S. chelicornis* Licht. Abdomen of adult female in ventral view.

PLATE IV.

Fig. 12. *Solpuga venator* Poc. Chelicera of adult male from Alicedale: enlarged.

Fig. 13. *S. strepsiceros* Kraep. Chelicera of adult male from Barberton: enlarged.

Fig. 14. *S. bechuanica* Hewitt. Chelicera of adult male from Serowe: enlarged.

Fig. 15. *S. schlechteri* Purc. Chelicera of adult male from Keimoes: enlarged.

Fig. 16. *S. hostilis* White. Ventral surface of trunk of adult male from Pretoria.

Fig. 17. *S. hostilis* White. Ventral surface of trunk of adult female from Pretoria.

PLATE V.

Fig. 18. *Solpuga spiralicornis* Purcell. Chelicera of adult male from Griffin Mine, Leydsdorp: enlarged.

Fig. 19. *S. ornithorhyncha* Hewitt. Chelicera of adult male from the neighbourhood of Kraikluft: enlarged.

Fig. 20. *Ceroma pictulum* Poc. Chelicera of adult male described as *C. leppanae* mihi: enlarged.

Fig. 21. *Solpuga globicornis* Kraep. Chelicera of adult male from Pretoria dist.: enlarged.

Fig. 22. *S. suffusca* Hewitt. Chelicera of adult male: enlarged.

Fig. 23. *S. maraisi* Hewitt. Chelicera of adult male from Stellenbosch: enlarged.

Fig. 24. *S. lateralis* Koch. Chelicera of male from Bussacks: enlarged.

PLATE VI.

Fig. 25. *Zeriassa purcelli* Hewitt. Chelicera of female specimen from Newington: enlarged.

Fig. 26. *Solpuga fusca* Koch. Chelicera of female specimen from Capetown: enlarged.

Fig. 27. *Daesia lineata* (Pocock). Chelicera of adult male from De Aar: enlarged.

Fig. 28. *D. lineata* (Poc.). Female example from De Aar.

Fig. 29. *Solpuga hostilis* White. Chelicera of male example from Doornkop: enlarged.

Fig. 30. *S. marshalli* Poc. Chelicera of adult male from Salisbury: enlarged.

Fig. 31. *Daesia lineata* (Poc.). Male example from De Aar: enlarged.

Fig. 32. *Solpuga celeripes* Hirst. Chelicera of adult male: locality unknown.

Fig. 33. *S. lineata* Koch. Chelicera of adult male from Alicedale: enlarged.

PLATE VII.

- Fig. 34. *Solpuga alcicornis* Kraep. Chelicera of adult male from Kuruman: enlarged.
 Fig. 35. *S. tubicen* Kraep. Chelicera of adult male from locality unknown: enlarged.
 Fig. 36. *Zeriassa purcelli* Hewitt. Chelicera of male from Newington: enlarged.
 Fig. 37. *S. lethalis rectus* var. nov. Chelicera of male from Windhuk: enlarged.
 Fig. 38. *S. monteiroi* Poc. Chelicera of male from Rustenburg dist.
 Fig. 39. *Blossia unguicornis* Purcell. Adult female from Alicedale: enlarged.
 Fig. 40. *B. unguicornis* Purcell. Adult male from Alicedale: enlarged.

PLATE VIII.

- Fig. 41. *Hexisopus lanatus* Koch. Male example in ventral view: enlarged.
 Fig. 42. *Hemiblossia O'neili* Purcell. Fourth leg of female example from Alicedale: enlarged.
 Fig. 43. *Daesia lineata* (Poc.). Ventral view of anterior portion of abdomen of male, showing first three sternites and basal segments of fourth leg: enlarged.
 Fig. 44. *Blossia unguicornis* Purcell. Ventral view of abdomen of male: enlarged.
 Fig. 45. *Chelypus hirsti* Hewitt. Chelicera of male from Rietfontein, Gordonia: enlarged.
 Fig. 46. *Blossia unguicornis* Purcell. Fourth leg of male from Alicedale: enlarged.

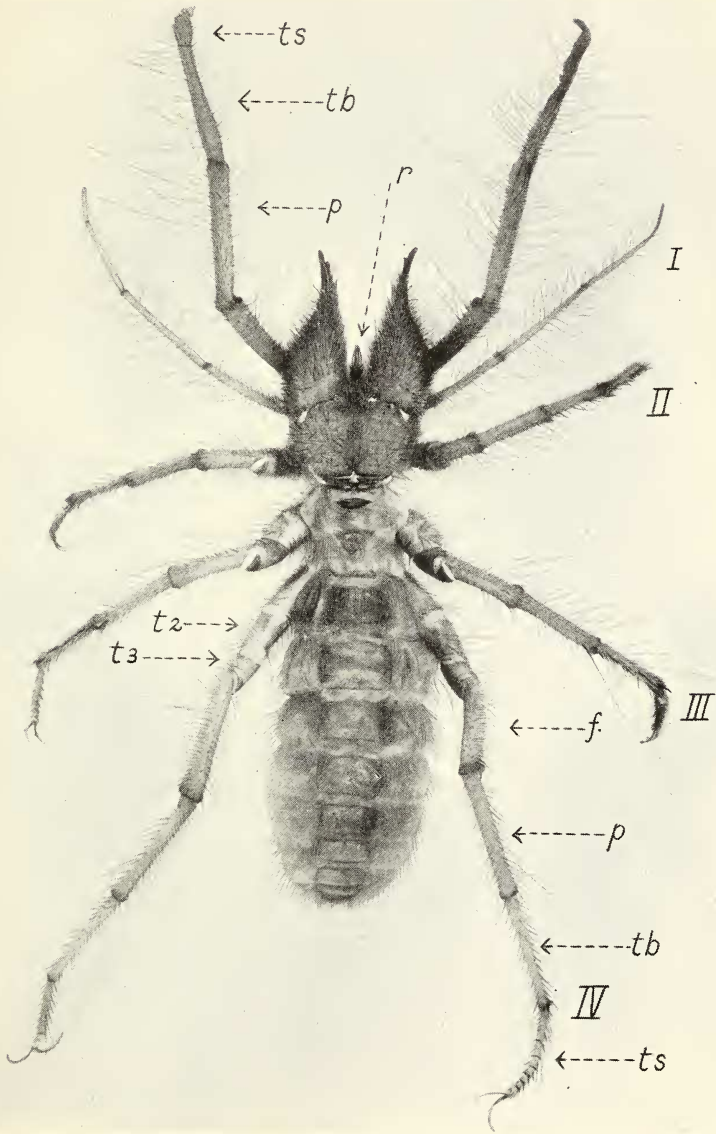
LIST OF RECENT LITERATURE ON THE
S. AFRICAN SOLIFUGAE

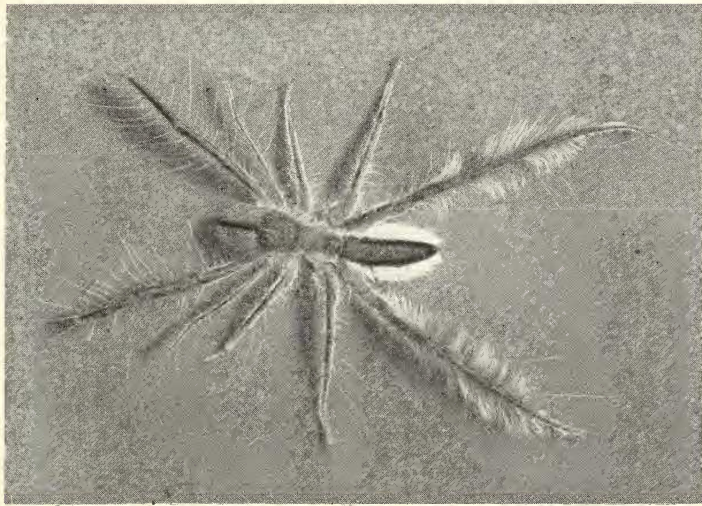
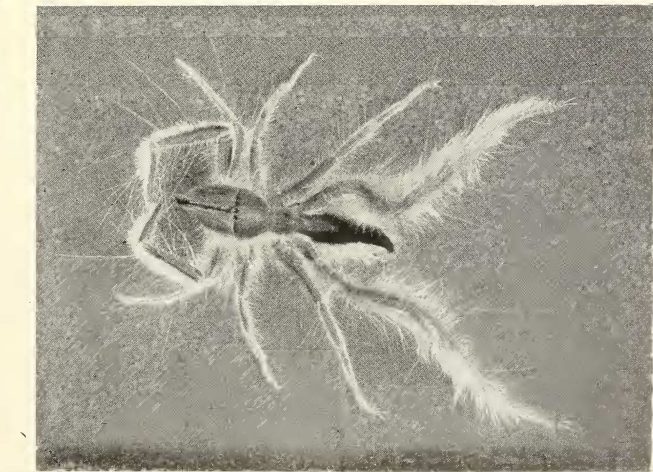
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 (3) — Skorpione und Solifugae, in *Beitr. zur Kenntnis der Land- und Süßwasserfauna Deutsch-Südwestafrikas*. Hamburg, 1914, pp. 107-136.
 (4) — Neue Beiträge zur Systematik der Gliederspinnen, in *Mit. aus d. Nat. Museum Hamburg*, xxviii. pp. 59-107. 1911.
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 (6) — On some new or little known Thelyphonidae and Solifugae, in *Ann. Mag. Nat. Hist.* 7, v. pp. 294-306. 1900.
 (7) Some new Arachnida from Cape Colony, in *Ann. Mag. Nat. Hist.* 7, vi. pp. 316-333. 1900.
 (8) — Descriptions of some new species of African Solifugae and Araneae, in *Ann. Mag. Nat. Hist.* 7, x. pp. 6-27. 1902.
 (9) PURCELL, W. F. New and little known South African Solifugae in the collection of the South African Museum, in *Ann. S. Af. Mus.* i. pp. 381-432. 1899.
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 (11) — Description of new genera and species of South African Solpugidae, in *Ann. S. Af. Mus.* iii. pp. 1-12. 1903.
 (12) — New Arachnida collected by Mr S. C. Cronwright-Schreiner at Hanover, Cape Colony, in *Ann. S. Af. Mus.* iii. pp. 13-40. 1903.
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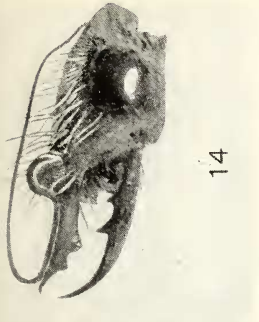




Diurnal Solifugae







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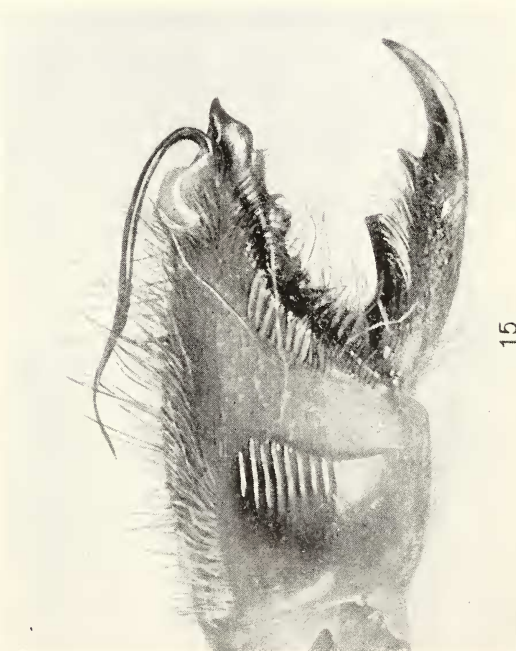
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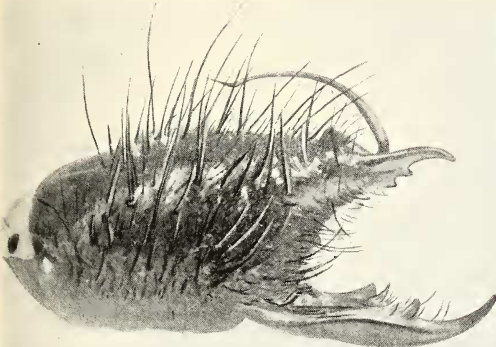
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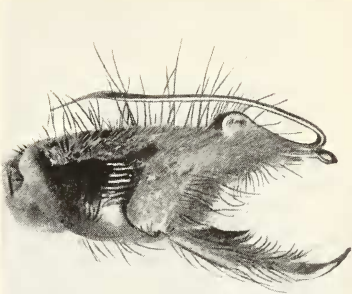
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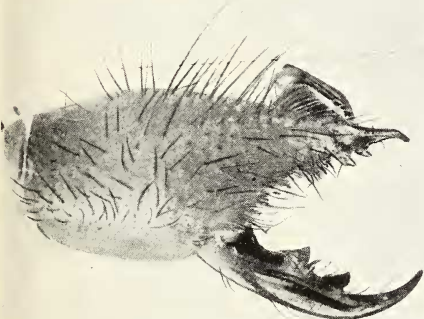
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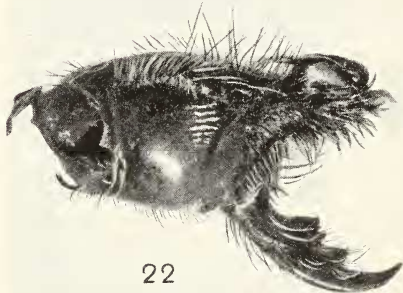
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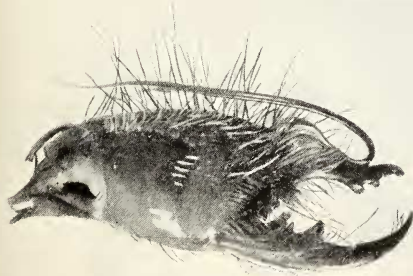
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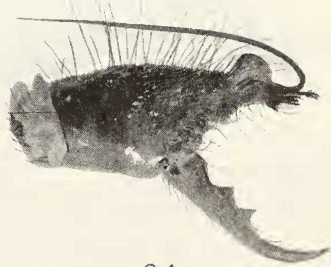
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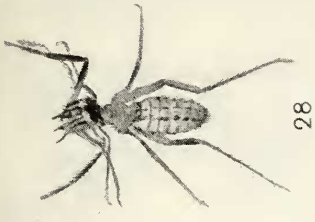
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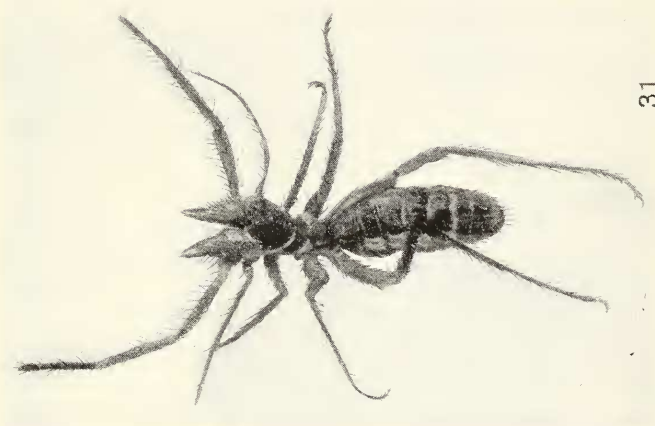
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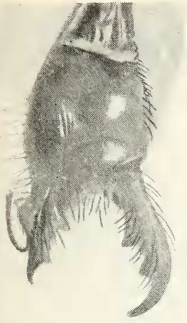
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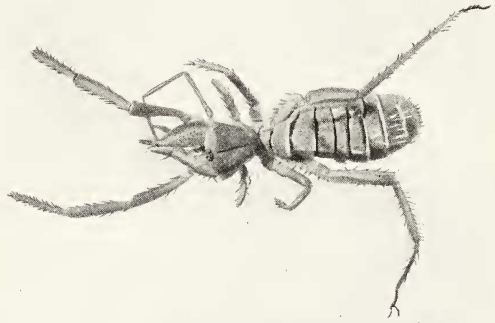
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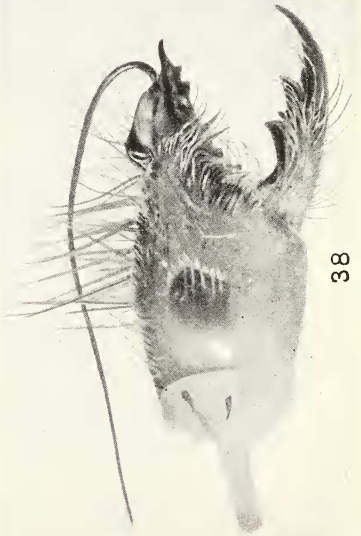
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